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REMD SECTION



ADDITIONAL OFF-SITE

CHARACTERIZATION REPORT

1991 SOIL SAMPLING

ORTHO-CHEVRON FACILITY

MARYLAND HEIGHTS, MISSOURI

Prepared for
Chevron Chemical Company
San Ramon, California
January 24, 1992

Woodward-Clyde Consultants
5055 Antioch Road
Overland Park, Kansas 66203

Project No. 13C114-22

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Chevron Chemical Company

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Mail Address: P.O. Box 5047, San Ramon, CA 94583-0947

February 5, 1992

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REMEDIATION SECTION

Maryland Heights
CERCLA Project
1991 Sampling Plan
Off-Site Soil Characterization

Ms. Catherine M. Barrett
Superfund Branch
EPA Region VII
726 Minnesota Avenue
Kansas City, KS 66101

Dear Ms. Barrett:

This letter transmits the results of the Additional Off-Site Characterization Report, summarizing June 1991 soil sampling activities conducted at the Chevron Chemical Company facility in Maryland Heights, Missouri. This investigation was based on the 1991 Work Plan which was approved by EPA in your letter dated May 3, 1991. The sampling activities focused on the off-site railroad easement which parallels the east and northeast property lines of the main Chevron facility.

Included with the Characterization Report is Chevron's recommendation for additional response action at the site. The areas proposed for this action are shown in Figure 3 and include off-site areas along the railroad easement. Selection of the response areas was based on the constituent concentrations in the soil which were above either the health-based target concentrations for total pesticides or arsenic. The target concentrations and appropriate response action were determined in the Development of Off-site Health-based Target Concentrations Report (June 6, 1990). Surface capping of soils was identified as the appropriate response action to remove existing routes of exposure, consistent with previous EPA approved actions.

We plan to proceed with the design and implementation of the surface capping, with an estimated completion date in mid-summer, 1992. If you have any questions concerning the report or proposed response action, please contact me at (510) 842-2437.

Very truly yours,

Nancy S. Zavesky
Nancy S. Zavesky

NSZ:nsz
Attachment

cc: Ms. Julie Warren
Missouri Department of Natural Resources
Division of Environmental Quality
P. O. Box 176
Jefferson City, MO 65102

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EXECUTIVE SUMMARY

Various field investigations have been conducted at the Ortho-Chevron Consumer Products Division facility in Maryland Heights, Missouri to characterize the nature and extent of contamination associated with the site and surrounding areas. Previous studies are summarized in a variety of reports, the most comprehensive being the revised Site Characterization Report (SCR) dated February 10, 1988 and the Supplemental Field Investigation Report dated October 23, 1989.

This report summarizes the results of soil sampling activities conducted in June 1991 which focused on the off-site railroad easement which parallels the east and northeast property lines of the main Chevron facility. Planned off-site actions to reduce existing routes of exposure within the off-site railroad easement are also included by evaluating all analytical data from previous field investigations.

A review of the June 1991 soil sampling activities and the previous sampling activities conducted in 1987 and 1989, identified the vertical and horizontal extent of contamination along the off-site railroad spur of the Ortho-Chevron Facility in Maryland Heights, Missouri. From the field investigations results, portions of the off-site soil contained pesticides and arsenic concentrations above the health-based target concentrations of 39.2 mg/kg for total pesticides and 127 mg/kg arsenic which were identified in the Development of Off-site Health-based Target Concentrations dated June 6, 1990. General trends in analytical data suggest that the constituents of concern are present in the surface or near surface soil but have not migrated in great extent downward to depths greater than six feet.

The off-site railroad spur is located along the north and east side of the main Chevron facility property line. The area consists of railroad ballast, road material, miscellaneous debris, and grass. Drainage of the area is split by the higher relief associated with the

railroad spur; drainage is east to west in small ditches along the spur. A small section located on the site's east side and east of the railroad spur drains off-site to the north.

Ten soil borings were completed by both hand and drilling rig sampling techniques on June 20, 1991. Each boring was sampled at four distinct intervals from zero to six feet: 0-0.5 feet, 0.5-2 feet, 2-4 feet and 4-6 feet. Chemical analysis of the soil samples was conducted by Enseco, Inc., and consisted of the following: BHC isomers, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, dieldrin, heptachlor, chlordane, and arsenic. These analytes were selected based on a review of the existing data.

Total pesticide concentrations found in the soil samples ranged from 0.0117 mg/kg (Boring 9103-4) to 53 mg/kg (Boring 9104-1) (Table 1). Sample intervals in soil borings 9102 and 9104 had the highest total pesticides with maximum concentrations of 44 mg/kg and 53 mg/kg, respectively. These were the only two borings with total pesticide concentrations greater than the health-based target concentration of 39.2 mg/kg. The individual pesticide constituent, 4,4'-DDT, was most frequently detected and had the highest concentration compared to other pesticides. Soil samples with detected 4,4'-DDT had concentrations ranging from 0.0092 mg/kg to 53 mg/kg. Aldrin and heptachlor were not detected above their respective detection limit in any of the soil samples.

Total arsenic was detected in every sample from the off-site railroad easement. Reported concentrations ranged from 3.4 mg/kg, background, (Boring 9110-2) to 332 mg/kg (Boring 9104-1) (Table 1). Soil boring locations 9102, 9104, 9108, and 9109 contained samples which had total arsenic concentrations above the arsenic health-based target concentration of 127 mg/kg.

Concentrations of the selected constituents generally decreased with depth, and the soil samples collected north or northeast of the railroad spur had lower concentrations than the borings south of the railroad spur (Figure 3). It is likely that the constituents of concern migrated from the plant area north to the soils around the railroad via surface water runoff and/or railroad off and on loading. Due to the railroad spur dividing the

drainage network, areas north and northeast of the spur contained lower concentrations of the analytes of interest than areas south and southwest of the spur.

Evaluating the analytical data of soil samples collected over the July 1987, March/April 1989, and June 1991 field investigations, the off-site areas along the railroad easement recommended for planned response actions are identified in Figure 3. Selection of the response areas was based on constituent concentrations in the soil which were above either the health-based target concentrations for total pesticides or arsenic. The response actions recommended by the Development of Off-site Health-based Target Concentrations Report (June 6, 1990) to remove the existing routes of exposure and thus reduce the potential health risks was surface capping.

A revised Site Characterization Report (SCR) dated February 10, 1988 was submitted by Chevron Chemical Company (Chevron) to the U.S. Environmental Protection Agency (USEPA) and the Missouri Department of Natural Resources (MDNR) to summarize the environmental and hydrogeologic studies conducted at the Ortho-Chevron Consumer Products Division facility in Maryland Heights, Missouri through July 1987. Since that time, additional field investigations have been conducted at the site to fill identified information data gaps in the site characterization and to provide additional information for evaluation of potential remedial measures. An additional field investigation conducted is summarized in the "Supplemental Field Investigation Report, 1989 Soil Sampling and Off-site Well Survey" dated October 23, 1989.

This report supplements these previous investigations and summarizes soil sampling activities conducted at the site in June 1991. The June 1991 soil sampling activities were conducted as discussed in the Work Plan Amendments, dated December 14, 1990. The major objective of this field investigation was to further define the extent of contamination along the off-site railroad spur located adjacent to the north and east property boundaries of the site. Ten soil borings located along the off-site railroad spur were sampled at discrete intervals from zero to six feet. The soil samples were analyzed for select pesticides and arsenic.

2.0**SITE LOCATION AND DESCRIPTION**

A detailed description of the project site, including plant history, geology, and hydrogeology are presented in the revised SCR dated February 10, 1988. A brief description of the project site is given with emphasis on the field investigation area which was conducted in June 1991.

The Chevron facility is located at 2497 Adie Road in an established industrial area in Maryland Heights, St. Louis County, Missouri. The facility is approximately 15 miles west of the St. Louis downtown area in the southwest quarter of Section 23, Township 46 North, Range 5 East. The site lies within the Fee Fee Creek watershed, and surface water drainage in the vicinity of the site is to the west or northwest. Fee Fee Creek ultimately drains into the Missouri River approximately 5 miles to the northwest (Figure 1). The site's topographic relief is gentle and has total relief of 28 feet from the high at the southeast property line to the low at the northwest property line.

The Maryland Heights facility property is rectangular with the long axis oriented east-west (Figure 2). Recently, Ortho-Chevron has purchased warehouses adjacent to the site on the north property line which extends the property boundaries farther north. To be consistent with previous field investigations, this purchased property will be considered as off-site property. The property line identified on Figure 2 represents the previous site boundaries.

Plant facilities include office buildings, parking lots, storage tanks, and two series of production buildings located adjacent to two railroad spurs. The majority of the site is either paved or occupied by buildings.

The extreme western portion of the site is currently being remediated as described in the Supplemental Field Investigation Report, dated October 23, 1989. This area is being capped with low permeability materials to further reduce surface water infiltration within the site. Surface drainage on the site is generally from east to west, emptying

into a drainage ditch which flows from south to north along the undeveloped western portion of the site. The drainage ditch is currently being replaced with a subsurface storm sewer to reduce surface water infiltration and possible migration of contaminants. The ditch enters a 30-inch culvert near the north property line. The culvert is part of a storm sewer system which discharges into Fee Fee Creek.

Other drainage features at the site include a HDPE-lined storm water retention and spill containment basin located in the northwestern portion of the site and immediately east of the drainage ditch described above. The location of the containment pond is illustrated in Figure 2. The existing containment basin is currently being remediated and will be replaced with a larger basin designed to minimize seepage losses from the basin.

During the field investigation conducted in June 1991, soil samples were collected for chemical analysis off-site along the north and east sides of the property boundaries. This area was previously developed as a railroad easement with spurs serving the Chevron plant and neighboring facilities. The area contains grass, road material, railroad ballast and miscellaneous debris. The northeast property line is drained by a small ditch that flows east to west discharging into a 30-inch culvert along the north property line. The east property line area drains by surface runoff either to the west or to the north.

3.0

PREVIOUS STUDIES SUMMARY

3.1 PREVIOUS INVESTIGATION AND ASSESSMENTS

As part of the Administrative Consent Agreement and Consent Order dated July 15, 1987 between Chevron and USEPA, a Work Plan was prepared by Chevron and its consultant, Woodward-Clyde Consultants (WCC), to guide proposed field and office studies at the Maryland Heights facility. Field investigations described in the work plan were completed in the summer of 1987 and summarized in the revised Site Characterization Report (SCR) dated February 10, 1988. A supplement field investigation was conducted by WCC in March/April 1989 following Work Plan Amendments dated March 8, 1989. Following agency review of the Supplement Field Investigation Report dated October 23, 1989, amendments to the June 26, 1987 Work Plan and March 8, 1989 Work Plan Amendments were prepared by Chevron and WCC to guide supplement studies and address identified data gaps. The Work Plan Amendments dated December 14, 1990 provided for the following major task:

- Evaluate the extent of contamination along the off-site railroad spur located along the north and east side of the main Chevron facility property line.

An Endangerment Assessment (EA) dated October 9, 1989 was prepared using data from the SCR and the Supplement Field Investigation Report to evaluate the potential health risks for several exposure scenarios that were designed to be representative of the types of work-related activities that are performed in the off-site area. Exposure scenarios were designed to evaluate potential health risks to persons who may be in the area of soil contamination.

Based on the exposure scenario, the Development of Off-site Health-based Target Concentrations Report established health-based target concentrations for arsenic and

total pesticides. The target concentrations established for the off-site areas were 127 mg/kg for arsenic and 39.2 mg/kg for total pesticides.

The following reference documents contain information related to other completed field investigation tasks described in the Work Plan Amendments.

- "Report of the Estimated Cancer Risk Associated with the Inhalation of Airborne Contaminants, Ortho-Chevron Site", dated April 18, 1989. This report contains the results of ambient air sampling conducted at the site in September 1988 and an evaluation of potential health risks associated with inhalation of airborne contaminants.
- "Annual Groundwater Monitoring Reports" are dated July 10, 1989, July 31, 1990, and July 1991. These reports include the results of quarterly sampling at the site for the annual period from June to April.
- "Endangerment Assessment", dated October 9, 1989. This report evaluates the potential health risks associated with exposure to contaminants in site soils and groundwater.
- "Supplemental Field Investigation Report, 1989 Soil Sampling and Off-site Well Survey", dated October 23, 1989. This report contains the results of soil sampling conducted at the site in March/April 1989.
- "Development of Off-site Health-based Target Concentrations", dated June 6, 1990. This report based on exposure scenarios identified in the Endangerment Assessment established target concentrations for total pesticides and arsenic which would be protective of human health.

The reports listed above have been previously transmitted to USEPA and MDNR by Chevron.

3.2 SUMMARY OF MARCH/APRIL 1989 OFF-SITE SOIL SAMPLING

Soil samples were collected and analyzed in March and April of 1989 in the off-site area located adjacent to the north property boundary. This section summarizes the analytical data results as presented in the "Supplement Field Investigation Report" dated October 23, 1989. Twenty-four borings were drilled and sampled to characterize the vertical and horizontal extent of contamination within the vacant areas immediately north of the site property and adjacent to the former arsenic off-loading area (Figure 2). Soil samples were taken at the following select intervals: (1) 0 to 0.5 feet, (2) 0.5 to 2.0 feet, (3) 2.0 to 4.0 feet, and (4) 4.0 to 6.0 feet. The samples were analyzed for 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Maneb, lindane, aldrin, chlordane, dieldrin, heptachlor, 2,4-D, 2,4,5-T, xylol, and arsenic.

3.2.1 Soil Sampling Results from the Former Arsenic Off-Loading Area

Seven borings were drilled and sampled along the railroad easement in the area adjacent to the former arsenic off-loading area. Total pesticides and arsenic concentrations detected in the soil samples are summarized below.

TOTAL PESTICIDES CONCENTRATIONS (mg/kg)

<u>Boring</u>	<u>Sampling Intervals</u>			
	<u>0-0.5'</u>	<u>0.5-2'</u>	<u>2.0-4.0'</u>	<u>4.0-6.0'</u>
8916	8.39	191.8	NA	NA
8917	5.72	52.7	NA	NA
8918	0.73	79.7	NA	NA
8925	25.0	ND	NA	NA
8926	111.7	7.5	23.7	21.3
8927	362.5	51.4	76.4	2.50
8928	306.0	63.1	356.8	4.66

ARSENIC CONCENTRATIONS (mg/kg)

<u>Boring</u>	<u>Sampling Intervals</u>			
	<u>0-0.5'</u>	<u>0.5-2.0'</u>	<u>2.0-4.0'</u>	<u>4.0-6.0'</u>
8916	13	41	NA	NA
8917	27	37	17	24
8918	7.5	26	NA	NA
8925	500	270	360	7
8926	340	18	20	1.5
8927	490	220	180	3.2
8928	1200	97	280	130

ND = Not detected.

NA = Not analyzed.

3.2.2 Soil Sampling Results from Off-Site Drainage Ditch

Borings 8931, 8933, 8935, and 8937 were drilled along a drainage ditch located near the north property line (Figure 2). This ditch receives runoff from the off-site property as well as portions of the site. Flow in the ditch is from east to west.

The constituent concentrations observed in the drainage ditch are summarized below.

TOTAL PESTICIDES CONCENTRATIONS (mg/kg)

<u>Boring</u>	<u>Sampling Intervals</u>			
	<u>0-0.5'</u>	<u>0.5-2.0'</u>	<u>2.0-4.0'</u>	<u>4.0-6.0'</u>
8931	43.4	17.6	NA	NA
8933	5.9	113.4	0.12	0.66
8935	14.0	28.6	NA	NA
8937	8.3	21.4	NA	NA

ARSENIC CONCENTRATIONS (mg/kg)

<u>Boring</u>	<u>Sampling Intervals</u>			
	<u>0-0.5'</u>	<u>0.5-2.0'</u>	<u>2.0-4.0'</u>	<u>4.0-6.0'</u>
8931	260	250	19	24
8933	320	840	13	16
8935	820	910	280	110
8937	310	400	NA	NA

ND = Not detected.

NA = Not analyzed.

The data summary indicated that relatively low to moderate concentrations of pesticides are present within the off-site drainage ditch. Arsenic was found in all of the borings. The maximum concentration of total pesticides was 113.4 mg/kg from the 0.5 to 2.0 feet sampling interval of boring 8933, and for arsenic was 910 mg/kg from the 0.5 to 2.0 feet sampling interval of boring 8935.

It is noted that the previous sampling activities in 1987 included an existing spoil area located east of the containment basin and south of the off-site drainage ditch. The previous studies found high concentrations of arsenic and other constituents of concern in the vicinity of the waste pile. It is possible that runoff from the waste pile may have influenced constituent concentrations along the off-site drainage ditch.

3.2.3 Soil Sampling Results of Northwest Off-site Area

Thirteen borings were drilled and analyzed along the former railroad easement and grassy areas adjacent to an existing parking lot located northwest of the property boundary (Figure 2). Total pesticides and arsenic concentrations detected in the soil samples are summarized below.

TOTAL PESTICIDES/CONCENTRATIONS (mg/kg)

<u>Boring</u>	<u>Sampling Intervals</u>			
	<u>0-0.5'</u>	<u>0.5-2.0'</u>	<u>2.0-4.0'</u>	<u>4.0-6.0'</u>
8914	0.08	ND	NA	NA
8915	ND	ND	NA	NA
8919	0.84	ND	NA	NA
8920	1.17	0.57	NA	NA
8921	0.31	0.11	NA	NA
8922	0.68	0.133	NA	NA
8923	1.40	0.017	NA	NA
8924	0.88	NA	NA	NA
8929	1.08	0.54	NA	NA
8930	1.25	1.02	NA	NA
8932	137.2	11.3	NA	NA
8934	5.5	2.3	NA	NA
8936	87.6	20.2	NA	NA

ARSENIC CONCENTRATIONS (mg/kg)

<u>Borings</u>	<u>Sampling Intervals</u>			
	<u>0-0.5'</u>	<u>0.5-2.0'</u>	<u>2.0-4.0'</u>	<u>4.0-6.0'</u>
8914	5.5	3.1	NA	NA
8915	3.3	5.3	NA	NA
8919	6.9	4.4	NA	NA
8920	13.0	12.0	NA	NA
8921	8.6	7.1	NA	NA
8922	15.5	6.5	8.0	15.0
8923	27	21	NA	NA

ARSENIC CONCENTRATIONS (mg/kg) cont'd

<u>Borings</u>	<u>Sampling Intervals</u>			
	<u>0-0.5'</u>	<u>0.5-2.0'</u>	<u>2.0-4.0'</u>	<u>4.0-6.0'</u>
8924	7.2	NA	NA	NA
8929	9.1	5.0	NA	NA
8930	18	11	NA	NA
8932	240	43	NA	NA
8934	60	ND	NA	NA
8936	110	140	23	1500

ND = Not detected.

NA = Not analyzed.

The data summary indicated that the majority of the off-site area defined by these borings exhibits relatively low constituent concentrations except at borings 8932, 8934 and 8936. At these three locations, moderate concentrations of pesticides or arsenic or both were detected. All three borings are located immediately north of the north property line and north of the off-site drainage ditch defined by the four borings: 8931, 8933, 8935 and 8937. The analytical data for the off-site borings suggests that the previous plant activities may have influenced constituent concentrations immediately to the north property line but have had only a minor impact on the areas farther from the site.

4.1 SOIL SAMPLING

Soil sampling was conducted in June 1991 along the railroad easement located along the north and east boundaries of the site. All field work was accomplished in general accordance with Section 3.0 of the Work Plan Amendments dated December 14, 1990.

Ten soil borings were located by following the March/April 1989 soil sampling grid. Soil boring locations were alternated on both sides of the railroad easement with each boring being approximately 40 feet apart. The boring locations were located in the field by measuring the distance of borings from permanent locations, using two 100-foot measuring tapes. Boring locations 9101 through 9110 are shown on Figure 2.

Each boring was sampled at the following four intervals:

<u>Sample Number</u>	<u>Interval</u>
Boring 9101 -1	0.0 feet to 0.5 feet
-2	0.5 feet to 2.0 feet
-3	2.0 feet to 4.0 feet
-4	4.0 feet to 6.0 feet

Soil sampling was conducted by WCC personnel from the Maryland Heights, Missouri office on June 20, 1991. The 0 to 0.5 feet interval was hand sampled by using a decontaminated shovel. The other intervals were drilled by utilizing a CME-55 drilling rig, hollow stem augers, and a 2-inch or 3-inch O.D. split spoon sampler. All borings, except 9110 were advanced to a depth of 6 feet. Due to Boring 9110's location being inaccessible to the drill rig, only the top two intervals were sampled using a decontaminated shovel. All sampling equipment and personal protective equipment coming in contact with samples were decontaminated between sampling intervals and between borings.

A visual description of the undisturbed soil sample was conducted. Soil boring logs are presented in Appendix A. Each soil sample at the designated interval was then composited in the field by mixing the soil with stainless steel spoons and in stainless steel bowls. The composited sample was placed in a labeled 16-ounce glass jar and placed in an iced cooler.

For soil borings 9105 through 9109 the bottom two intervals (2.0 - 4.0 feet and 4.0 to 6.0 feet) were archived for potential future analysis by storing the samples in a locked freezer located within a secure building on-site. Depending on the chemical concentrations in the top intervals, the archived soil samples could be analyzed at a later date, but within the appropriate holding times. Soil samples 9108-3, 9108-4, 9109-3 and 9109-4 were archive samples that were analyzed at a later date for arsenic only. All soil samples were submitted under chain-of-custody protocol to Enseco (Rocky Mountain Analytical Lab), Inc., Arvada, Colorado for chemical analysis.

4.2 LABORATORY ANALYSES

Chemical analyses of the soil samples were conducted by Enseco, Inc. utilizing USEPA methods and in accordance with the procedures set forth in the approved Quality Assurance/ Quality Control Plan dated June 26, 1987. (Appendix 4 of the June 26, 1987 Work Plan). Soil samples collected during June 1991 were analyzed for:

Pesticides

alpha-BHC
beta-BHC
delta-BHC
gamma-BHC (lindane)
4,4'-DDD
4,4'-DDE
4,4'-DDT
Aldrin
Dieldrin
Heptachlor
Chlordane

Metals

Arsenic

4.3 QUALITY CONTROL SAMPLES

Quality assurance / quality control (QA/QC) for the soil sampling program was maintained by submitting duplicate samples at a 10 percent frequency to the analytical laboratories during the sampling event. Duplicates of samples for 9103-1, 9103-2, 9103-3, and 9103-4 were analyzed.

Enseco laboratories operate under a vigorous QA/QC program designed to ensure the generation of scientifically valid data by monitoring every aspect of laboratory operations. Routine QA/QC procedures include the use of approved methodologies, independent verification of analytical standards, duplicate Laboratory Control Samples to assess the precision and accuracy of the methodology on a routine basis, and a rigorous system of data review.

5.0

ANALYTICAL RESULTS

The analytical data for the soil samples collected at the site in June 1991 are summarized below. Ten soil borings were drilled as part of the supplemental field investigation conducted at the Maryland Heights, Missouri facility. From these borings, 42 soil samples (including duplicates) were submitted for chemical analyses. The analyte concentrations are included in Table 1. The complete analytical data packages, including laboratory quality control data, are presented in Appendix B.

5.1 PESTICIDES

Pesticides analyzed for in the soil samples included BHC isomers, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, aldrin, dieldrin, heptachlor and chlordane. Except for aldrin and heptachlor, all constituents were detected in at least one sample above their respective detection limits. At high concentrations of target compounds, some samples were diluted and the reporting limits are adjusted relative to the required dilution. From the previous field investigations at the Chevron Maryland Heights site, constituent concentration generally decreases with depth. Because of high concentrations of some constituents in the top interval, other target constituents may not be detected at the elevated reporting limit in the top interval but may be detected in the lower intervals where reporting limits are generally lower.

Total pesticides, determined by summing for each sample interval pesticide concentrations above the detection levels, ranged from 0.0117 mg/kg to 53.0 mg/kg. Sample intervals of soil borings 9102 and 9104 had the highest total pesticides with maximum concentrations of 44 mg/kg and 53 mg/kg, respectively. Total pesticides concentration for all borings decreases with depth (Table 1) except 9104. Samples from boring 9104 had minor differences between the bottom two intervals. For borings in which samples were analyzed from all four intervals, total pesticide concentration decreases from the top to bottom interval by at least one to three orders of magnitude.

Four BHC isomers were analyzed, alpha-, beta-, delta-, and gamma-BHC (lindane). Beta-BHC was the most frequently detected isomer and had sample concentrations which ranged from 0.0022 mg/kg to 3.7 mg/kg. The other BHC isomers with detected levels in the soil samples had concentrations ranging from 0.0023 mg/kg to 0.18 mg/kg.

4,4'-DDT was frequently detected in the soil samples at concentrations which ranged from 0.0092 mg/kg to 53 mg/kg (Table 1). Boring locations 9102, 9104, 9108, and 9109 samples with the highest concentrations in the top 0 to 0.5 foot interval with concentrations ranging from 12 mg/kg to 53 mg/kg. 4,4'-DDE was detected in majority of the samples with concentrations ranging from 0.0033 mg/kg to 8 mg/kg. 4,4'-DDD was detected in three soil samples with concentrations ranging from 0.0046 mg/kg to 3.9 mg/kg.

Other pesticides detected in the soil samples at low concentrations were dieldrin and chlordane. Dieldrin was detected in twelve samples and had concentrations range from 0.0056 mg/kg to 0.8 mg/kg. Chlordane was detected in five samples and had concentrations range from 0.017 mg/kg to 0.072 mg/kg. Aldrin and heptachlor were not detected above their respective detection limit in any of the soil samples.

5.2 ARSENIC

Total arsenic was detected in every sample from the off-site railroad easement (Table 1). Reported concentrations ranged from 3.4 mg/kg to 332 mg/kg. It appears from this and previous investigations that arsenic background levels for the soil range from three to ten mg/kg. The data generally shows concentrations decrease with depth. The concentrations for each interval had the following range:

<u>Sample Interval</u>	<u>Concentration (mg/kg)</u>	
	<u>Low Value</u>	<u>High Value</u>
0 to 0.5 feet	6.3	332
0.5 to 2.0 feet	4.3	239
2.0 to 4.0 feet	3.6	54.9

4.0 to 6.0 feet

3.4

34.1

Soil samples from borings 9102, 9104, and 9109 had the highest concentrations of arsenic in the top two intervals compared to the other borings. Maximum sample concentrations from these borings, 9102, 9104, and 9109 were 208 mg/kg, 332 mg/kg, and 239 mg/kg, respectively.

In July 1991, following review of the analytical data of the 0 to 0.5 feet and 0.5 to 2 feet intervals, the field archive samples from the 2 to 4 feet and 4 to 6 feet intervals in borings 9108 and 9109 were submitted to ENSECO, Inc. for analysis of arsenic only. The analytical data for these sample intervals are included in Table 1.

5.3 QUALITY CONTROL DATA

Duplicate samples were collected and analyzed from soil boring 9103. The duplicate sample analyses results are presented in Table 1. Analytical results of the duplicate samples compared favorably with the primary samples.

Laboratory control measures are included in the analytical data package (Appendix B). All laboratory control measures were within the laboratory's quality control limits.

5.4 DISCUSSION OF ANALYTICAL RESULTS

In view of the July 1987, March/April 1989, and June 1991 soil sampling data, the off-site railroad easement portion of the site has been investigated to identify the horizontal and vertical distribution of the constituents of concern. General trends of the 1987 and 1989 analytical data were discussed in the respective field investigation reports. This section compares the trends of 1987 and 1989 data with the data collected in 1991.

Six borings were sampled and analyzed in 1987 along the western end of the railroad spur in the area adjacent to the former arsenic off-loading area (Figure 2). The average concentration of arsenic in these borings was approximately 300 mg/kg. The average

concentrations of pesticides, excluding chlordane, varied from approximately 2.6 mg/kg to 70 mg/kg. 4,4'-DDT was also frequently detected in this area. Relatively low concentrations of 4,4'-DDD, 4,4'-DDE, dieldrin, aldrin, chlordane, and lindane were detected in the borings.

Twenty-four soil borings were sampled and analyzed in 1989 within the off-site railroad easement area as discussed in Section 3.2 of this report. Total pesticide concentrations of sample intervals ranged from no detection (boring 8925-2) to 362.5 mg/kg (boring 8927-1). Soil borings with sample intervals that had total pesticide concentrations above the 39.2 mg/kg health-based target pesticide concentration were: 8916, 8917, 8918, 8926, 8928, 8931, 8932, 8933 and 8936. Total arsenic was detected in all soil samples except for 8934-2. Soil borings with sample intervals that had total arsenic concentrations above the 127 mg/kg health-based target pesticide concentration were: 8925, 8926, 8927, 8928, 8931, 8932, 8933, 8935, 8936, and 8937. In general, higher pesticides and arsenic concentrations were observed in borings located south of the off-site railroad easement as opposed to borings located north of the railroad easement.

In general, the area sampled in 1991 had lower concentrations of total pesticides and total arsenic than the area sampled in 1989. All 1991 soil borings located south or southwest of the railroad spur had concentrations above the health-based target concentrations either for total pesticides or arsenic or both (Figure 3). All other 1991 soil borings located on the north and northeast side of the railroad spur were below the health-based target concentrations. As noted above, the 1989 soil samples located north of the railroad spur had lower concentrations than the borings south of the railroad spur. It is likely that the contamination observed in both sets of samples originated from the plant area and migrated via surface water runoff. Since the railroad is elevated and divides the surface water runoff network, the surface water from the plant drained into the ditch along the south side of the railroad track and was routed west (Figure 3). In large storms the surface water may have diverted over the railroad tracks and deposited constituents of concern on the north side of the tracks. Some contamination may also have originated from wind dispersion or leakage from the railroad cars.

6.0

PLANNED OFF-SITE ACTIONS

The off-site area selected for planned response actions was based on characterization studies conducted over a several year period, the Endangerment Assessment and the Development of Off-site Health-based Target Concentrations (DOHTC).

The Endangerment Assessment evaluated the potential health risks for several exposure scenarios that were designed to be representative of the types of work-related activities that are performed on-site. The DOHTC Report established health-based target concentrations for the off-site area immediately north and adjacent to the site. The health-based target concentration for arsenic is 127 mg/kg and for total pesticides is 39.2 mg/kg.

To remediate the area, the EA concluded that surface capping would remove the existing routes of exposure and thus reduce the potential health risks associated with soil ingestion, the inhalation of fugitive dust, and dermal contact. Surface capping would also be consistent with the response actions currently being implemented for the on-site areas.

Using the health-based target concentrations, areas around the soil borings with sample concentrations above these target concentrations are recommended for surface capping. The planned off-site response areas are shown on Figure 3. Soil borings with sample interval concentrations above the health-based target concentrations are listed below. The sample intervals with the maximum concentration of total pesticides and arsenic found in the boring are also included.

	Total Pesticides		Arsenic	
	Maximum Concentration	Sample Interval	Maximum Concentration	Sample Interval
<u>Soil Borings</u>	<u>(mg/kg)</u>	<u>(feet)</u>	<u>(mg/kg)</u>	<u>(feet)</u>
8916	191.8	0.5-2.0	41	0.5-2.0
8917	52.7	0.5-2.0	37	0.5-2.0
8918	79.7	0.5-2.0	26	0.5-2.0
8925	25.0	0 - 0.5	500	0 - 0.5
8926	111.7	0 - 0.5	340	0 - 0.5
8927	362.5	0 - 0.5	490	0 - 0.5
8928	356.8	0 - 0.5	1200	0 - 0.5
8931	43.4	0 - 0.5	260	0 - 0.5
8932	137.2	0 - 0.5	240	0 - 0.5
8933	113.4	0.5-2.0	840	0.5-2.0
8935	28.6	0.5-2.0	910	0.5-2.0
8936	87.6	0 - 0.5	1500	4.0-6.0
8937	21.4	0.5-2.0	400	0.5-2.0
9102	44.0	0.5-2.0	208	0.5-2.0
9104	53.0	0 - 0.5	332	0 - 0.5
9108	16.6	0 - 0.5	261	0 - 0.5
9109	31.1	0 - 0.5	239	0.5-2.0

The areas recommended for off-site response actions (surface capping) are located on both sides of the railroad easement within the western portion of the easement and are located on the south to southwest side of the railroad spur within the eastern portion of the spur (Figure 3). As discussed in the previous section, higher constituent concentrations were observed in borings located south of the off-site railroad spur versus borings located north of the railroad spur. Sample borings collected in 1991 which were located north of the railroad spur were below the health-based target concentrations for both total pesticides and arsenic and are not recommended for remediation (Figure 3). Sample borings collected in 1989 which were located south of the off-site parking lot near the northwest property boundary were also below the

health-based target concentrations and are not recommended for remediation (Figure 3).

TABLES

TABLE 1
CONSTITUENT CONCENTRATIONS IN SOIL BORING SAMPLES

BORING NUMBER (Sample Interval Feet)																	
CONSTITUENT	UNITS	9101-1 (0-0.5')		9101-2 (0.5-2.0')		9101-3 (2.0-4.0')		9101-4 (4.0-6.0')		9102-1 (0-0.5')		9102-2 (0.5-2.0')		9102-3 (2.0-4.0')		9102-4 (4.0-6.0')	
Chlorinated Pesticides																	
alpha-BHC	mg/kg	ND	(0.34)	ND	(0.17)	ND	(0.0017)	ND	(0.0017)	ND	(1.7)	ND	(0.68)	ND	(0.17)	ND	(0.085)
beta-BHC	mg/kg	1.4		0.54		0.023		0.014		ND	(1.7)	0.69		ND	(0.17)	ND	(0.085)
delta-BHC	mg/kg	ND	(0.34)	ND	(0.17)	0.0028		ND	(0.0017)	ND	(1.7)	ND	(0.68)	ND	(0.17)	ND	(0.085)
gamma-BHC (Lindane)	mg/kg	ND	(0.34)	ND	(0.17)	0.0023		ND	(0.0017)	ND	(1.7)	ND	(0.68)	ND	(0.17)	ND	(0.085)
4,4'-DDD	mg/kg	0.78		ND	(0.33)	0.0046		ND	(0.0033)	ND	(3.3)	ND	(1.3)	ND	(0.33)	ND	(0.16)
4,4'-DDE	mg/kg	1.6		0.69		0.0099		0.0034		8		2.1		0.61		0.35	
4,4'-DDT	mg/kg	5.5		2.4		0.017		0.019		36		8.6		2.9		1.5	
Aldrin	mg/kg	ND	(0.34)	ND	(0.17)	ND	(0.0017)	ND	(0.0017)	ND	(1.7)	ND	(0.68)	ND	(0.17)	ND	(0.085)
Dieldrin	mg/kg	0.8		ND	(0.33)	0.014		0.006		ND	(3.3)	ND	(1.3)	ND	(0.33)	ND	(0.16)
Heptachlor	mg/kg	ND	(0.34)	ND	(0.17)	ND	(0.0017)	ND	(0.0017)	ND	(1.7)	ND	(0.68)	ND	(0.17)	ND	(0.085)
Chlordane	mg/kg	ND	(3.4)	ND	(1.7)	0.046		ND	(0.017)	ND	(17)	ND	(6.8)	ND	(6.8)	ND	(0.85)
Total Pesticides Detected above Reporting Limits	mg/kg	10.08		3.63		0.1196		0.0424		44		11.39		3.51		1.85	
Metals																	
Arsenic	mg/kg	26.8		7.6		5.2		5.3		208		20.0		51.4		34.1	

ND - Not detected at the respective reporting limit.

NA - Not Analyzed

(1) Archive Sample; Only Arsenic Analyzed

TABLE 1 (cont'd)
CONSTITUENT CONCENTRATIONS IN SOIL BORING SAMPLES

		BORING NUMBER (Sample Interval Feet)							
CONSTITUENT	UNITS	9103-1 (0-0.5')	9103-1D (0-0.5')	9103-2 (0.5-2.0')	9103-2D (0.5-2.0')	9103-3 (2.0-4.0')	9103-3D (2.0-4.0')	9103-4 (4.0-6.0')	9103-4D (4.0-6.0')
Chlorinated Pesticides									
alpha-BHC	mg/kg	ND (0.17)	0.18	ND (0.0017)	ND (0.0017)	0.0018	ND (0.0017)	ND (0.0017)	ND (0.0017)
beta-BHC	mg/kg	ND (0.17)	0.23	0.02	0.018	0.014	0.012	0.0061	0.0070
delta-BHC	mg/kg	ND (0.17)	ND (0.17)	ND (0.0017)	ND (0.0017)	0.0020	ND (0.0017)	ND (0.0017)	ND (0.0017)
gamma-BHC (Lindane)	mg/kg	ND (0.17)	ND (0.17)	ND (0.0017)	ND (0.0017)	0.0025	ND (0.0017)	ND (0.0017)	ND (0.0017)
4,4'-DDD	mg/kg	ND (0.33)	ND (0.33)	ND (0.0033)	ND (0.0033)	ND (0.0033)	ND (0.0033)	ND (0.0033)	ND (0.0033)
4,4'-DDE	mg/kg	0.57	0.33	ND (0.0033)	ND (0.0033)	0.0033	ND (0.0033)	ND (0.0033)	ND (0.0033)
4,4'-DDT	mg/kg	1.6	0.91	ND (0.0033)	ND (0.0033)	ND (0.0033)	ND (0.0033)	ND (0.0033)	ND (0.0033)
Aldrin	mg/kg	ND (0.17)	ND (0.17)	ND (0.0017)	ND (0.0017)	ND (0.0017)	ND (0.0017)	ND (0.0017)	ND (0.0017)
Dieldrin	mg/kg	ND (0.33)	ND (0.33)	0.022	0.014	0.021	0.011	0.0056	0.0064
Heptachlor	mg/kg	ND (0.17)	ND (0.17)	ND (0.0017)	ND (0.0017)	ND (0.0017)	ND (0.0017)	ND (0.0017)	ND (0.0017)
Chlordane	mg/kg	ND (1.7)	ND (1.7)	0.021	ND (0.017)	0.072	0.038	ND (0.017)	ND (0.017)
Total Pesticides Detected above Reporting Limits	mg/kg	2.17	1.65	0.063	0.032	0.1166	0.061	0.0117	0.0134
Metals									
Arsenic	mg/kg	44.0	39.0	6.2	7.4	3.6	8.1	8.0	5.6

ND - Not detected at the respective reporting limit.

NA - Not Analyzed

(1) Archive Sample; Only Arsenic Analyzed

TABLE 1 (cont'd)
CONSTITUENT CONCENTRATIONS IN SOIL BORING SAMPLES

BORING NUMBER (Sample Interval Feet)																	
CONSTITUENT	UNITS	9104-1 (0-0.5')		9104-2 (0.5-2.0')		9104-3 (2.0-4.0')		9104-4 (4.0-6.0')		9105-1 (0-0.5')		9105-2 (0.5-2.0')		9106-1 (0-0.5')		9106-2 (0.5-2.0')	
Chlorinated Pesticides																	
alpha-BHC	mg/kg	ND	(17)	ND	(1.7)	ND	(0.034)	ND	(0.034)	ND	(0.017)	ND	(0.0017)	ND	(0.068)	ND	(0.0017)
beta-BHC	mg/kg	ND	(17)		3.7		0.068		0.089	ND	(0.017)		0.0022	ND	(0.068)		0.0074
delta-BHC	mg/kg	ND	(17)	ND	(1.7)	ND	(0.034)	ND	(0.034)	ND	(0.017)	ND	(0.0017)	ND	(0.068)	ND	(0.0017)
gamma-BHC (Lindane)	mg/kg	ND	(17)	ND	(1.7)	ND	(0.034)	ND	(0.034)	ND	(0.017)	ND	(0.0017)	ND	(0.068)	ND	(0.0017)
4,4'-DDD	mg/kg	ND	(33)	ND	(3.3)	ND	(0.066)	ND	(0.066)	ND	(0.033)	ND	(0.0033)	ND	(0.13)	ND	(0.0033)
4,4'-DDE	mg/kg	ND	(33)		3.3	ND	(0.066)		0.11		0.10		0.0081		0.31	ND	(0.0033)
4,4'-DDT	mg/kg		53		18		0.37		0.50		0.10		0.0092		0.81	ND	(0.0033)
Aldrin	mg/kg	ND	(17)	ND	(1.7)	ND	(0.034)	ND	(0.034)	ND	(0.017)	ND	(0.0017)	ND	(0.068)	ND	(0.0017)
Dieldrin	mg/kg	ND	(33)	ND	(3.3)	ND	(0.066)	ND	(0.066)		0.038		0.0043	ND	(0.13)		0.0049
Heptachlor	mg/kg	ND	(17)	ND	(1.7)	ND	(0.034)	ND	(0.034)	ND	(0.017)	ND	(0.0017)	ND	(0.068)	ND	(0.0017)
Chlordane	mg/kg	ND	(170)	ND	(17)	ND	(0.34)	ND	(0.34)	ND	(0.17)		0.017	ND	(0.68)	ND	(0.017)
Total Pesticides Detected above Reporting Limits	mg/kg		53		25.0		0.438		0.699		0.238		0.0408		1.12		0.0123
Metals																	
Arsenic	mg/kg		332		111		14.2		17.5		11.1		7.2		9.8		6.6

ND - Not detected at the respective reporting limit.

NA - Not Analyzed

(1) Archive Sample; Only Arsenic Analyzed

TABLE 1 (cont'd)
CONSTITUENT CONCENTRATIONS IN SOIL BORING SAMPLES

		BORING NUMBER (Sample Interval Feet)									
CONSTITUENT	UNITS	9107-1 (0-0.5')	9107-2 (0.5-2.0')	9108-1 (0-0.5')	9108-2 (0.5-2.0')	9108-3 (1) (2.0-4.0')	9108-4 (1) (4.0-6.0')	9109-1 (0-0.5')	9109-2 (0.5-2.0')		
Chlorinated Pesticides											
alpha-BHC	mg/kg	ND (0.17)	ND (0.068)	ND (1.7)	ND (0.0017)	NA	NA	ND (1.7)	ND (0.0017)		
beta-BHC	mg/kg	ND (0.17)	ND (0.068)	ND (1.7)	ND (0.0017)	NA	NA	ND (1.7)	ND (0.0017)		
delta-BHC	mg/kg	ND (0.17)	ND (0.068)	ND (1.7)	ND (0.0017)	NA	NA	ND (1.7)	ND (0.0017)		
gamma-BHC (Lindane)	mg/kg	ND (0.17)	ND (0.068)	ND (1.7)	ND (0.0017)	NA	NA	ND (1.7)	ND (0.0017)		
4,4'-DDD	mg/kg	ND (0.33)	ND (0.13)	ND (3.3)	ND (0.0033)	NA	NA	3.9	ND (0.0033)		
4,4'-DDE	mg/kg	0.45	0.25	4.6	0.0062	NA	NA	5.2	0.0061		
4,4'-DDT	mg/kg	1.9	0.65	12.0	0.0065	NA	NA	22.0	0.013		
Aldrin	mg/kg	ND (0.17)	ND (0.068)	ND (1.7)	ND (0.0017)	NA	NA	ND (1.7)	ND (0.0017)		
Dieldrin	mg/kg	ND (0.33)	ND (0.13)	ND (3.3)	0.0092	NA	NA	ND (3.3)	ND (0.0033)		
Heptachlor	mg/kg	ND (0.17)	ND (0.068)	ND (1.7)	ND (0.0017)	NA	NA	ND (1.7)	ND (0.0017)		
Chlordane	mg/kg	ND (1.7)	ND (0.68)	ND (17)	ND (0.017)	NA	NA	ND (17)	ND (0.017)		
Total Pesticides Detected above Reporting Limits	mg/kg	2.35	0.9	16.6	0.0219	-	-	31.1	0.0191		
Metals											
Arsenic	mg/kg	32.5	26.1	261	64.2	19.2	27.9	160	239		

ND - Not detected at the respective reporting limit.

NA - Not Analyzed

(1) Archive Sample; Only Arsenic Analyzed

TABLE 1 (cont'd)
CONSTITUENT CONCENTRATIONS IN SOIL BORING SAMPLES

BORING NUMBER (Sample Interval Feet)					
CONSTITUENT	UNITS	9109-3 (1) (2.0-4.0')	9109-4 (1) (4.0-6.0')	9110-1 (0-0.5')	9110-2 (0.5-2.0')
Chlorinated Pesticides					
alpha-BHC	mg/kg	NA	NA	ND (0.017)	ND (0.0034)
beta-BHC	mg/kg	NA	NA	ND (0.017)	ND (0.0034)
delta-BHC	mg/kg	NA	NA	ND (0.017)	ND (0.0034)
gamma-BHC (Lindane)	mg/kg	NA	NA	ND (0.017)	ND (0.0034)
4,4'-DDD	mg/kg	NA	NA	ND (0.033)	ND (0.0066)
4,4'-DDE	mg/kg	NA	NA	0.045	0.013
4,4'-DDT	mg/kg	NA	NA	0.16	0.045
Aldrin	mg/kg	NA	NA	ND (0.017)	ND (0.0034)
Dieldrin	mg/kg	NA	NA	ND (0.033)	ND (0.0066)
Heptachlor	mg/kg	NA	NA	ND (0.017)	ND (0.0034)
Chlordane	mg/kg	NA	NA	ND (0.17)	ND (0.034)
Total Pesticides Detected above Reporting Limits	mg/kg			0.205	0.058
Metals					
Arsenic	mg/kg	54.9	3.4	6.3	4.3

ND - Not detected at the respective reporting limit.

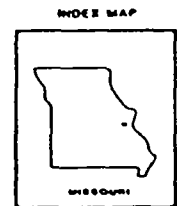
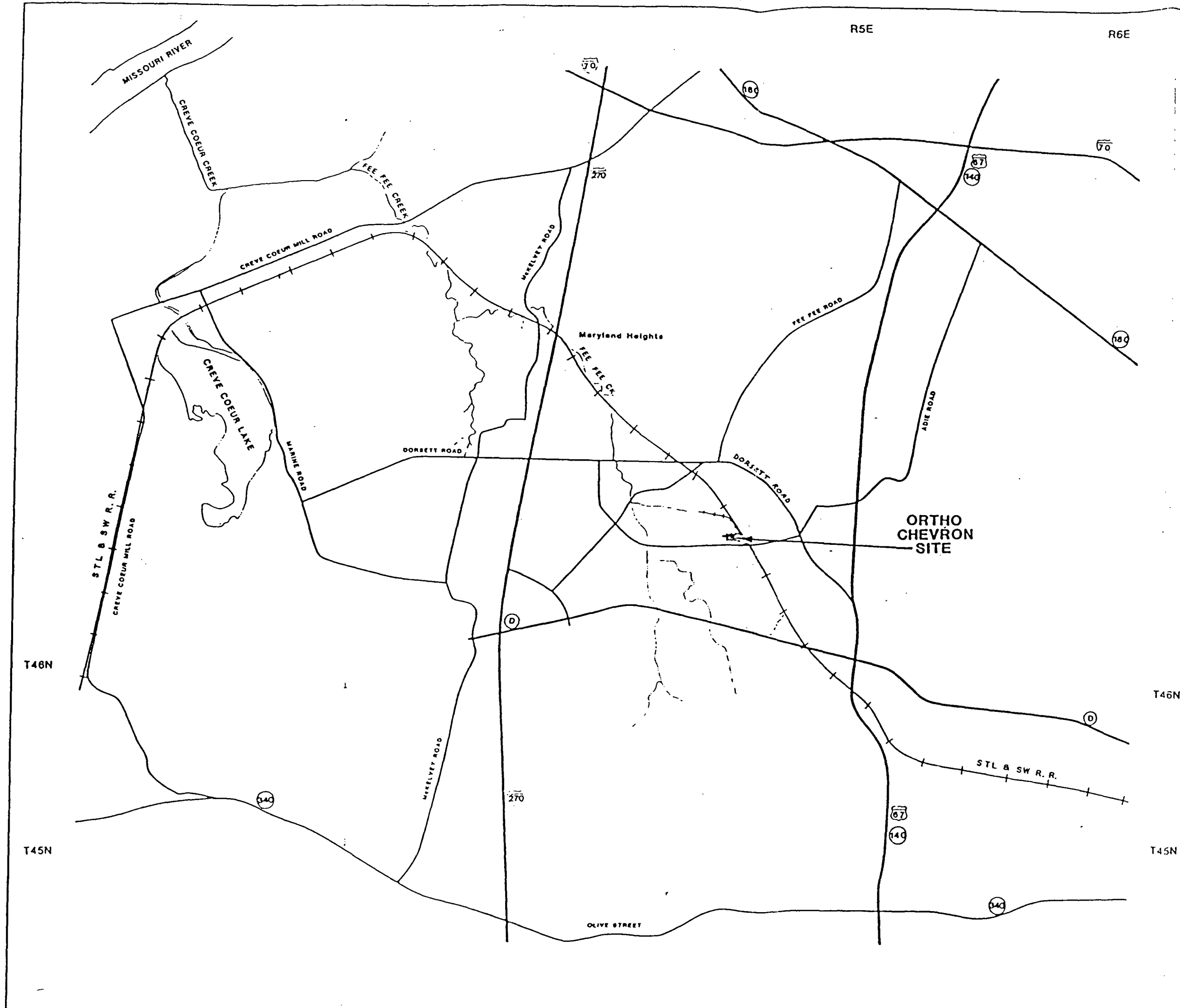
NA - Not Analyzed

(1) Archive Sample; Only Arsenic Analyzed

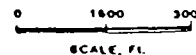
FIGURES



FIGURES



(Mapping information obtained from
USGS, Creve Coeur, Missouri Quadrangle,
1974)

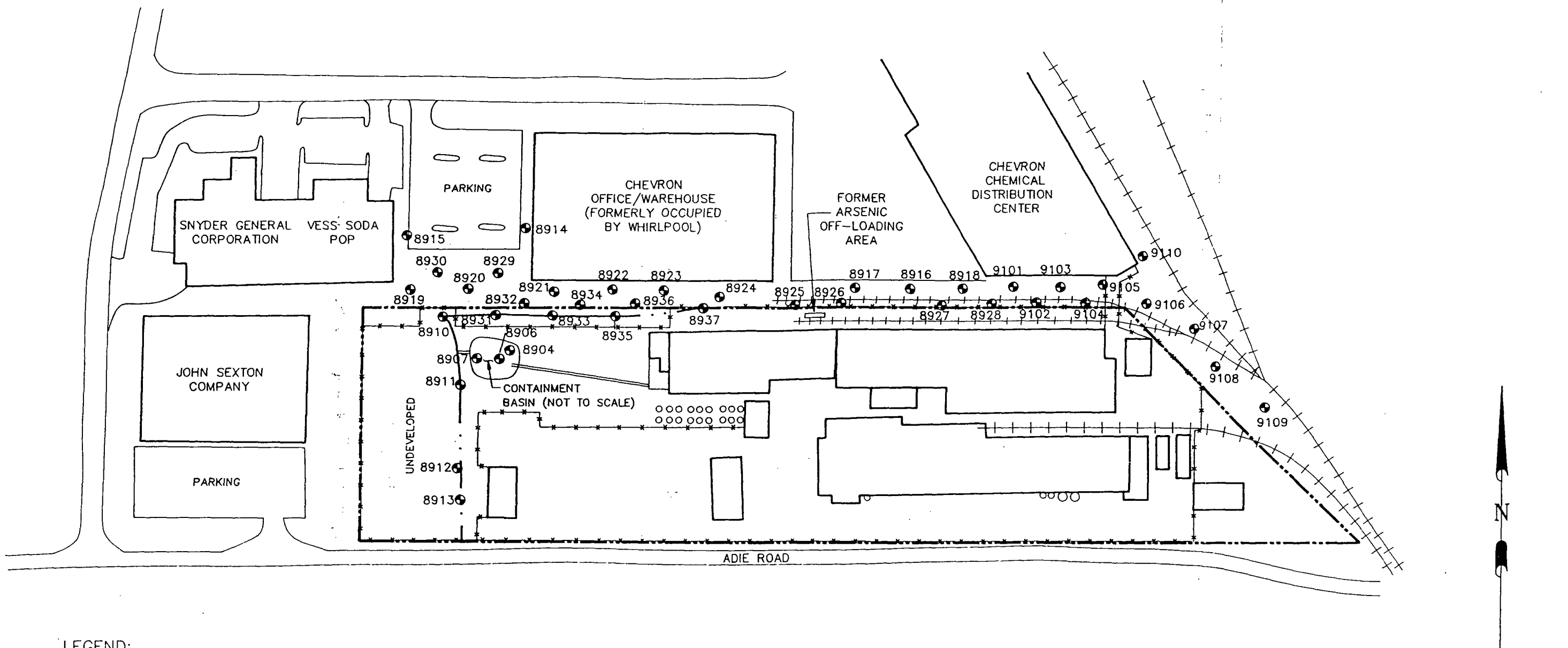


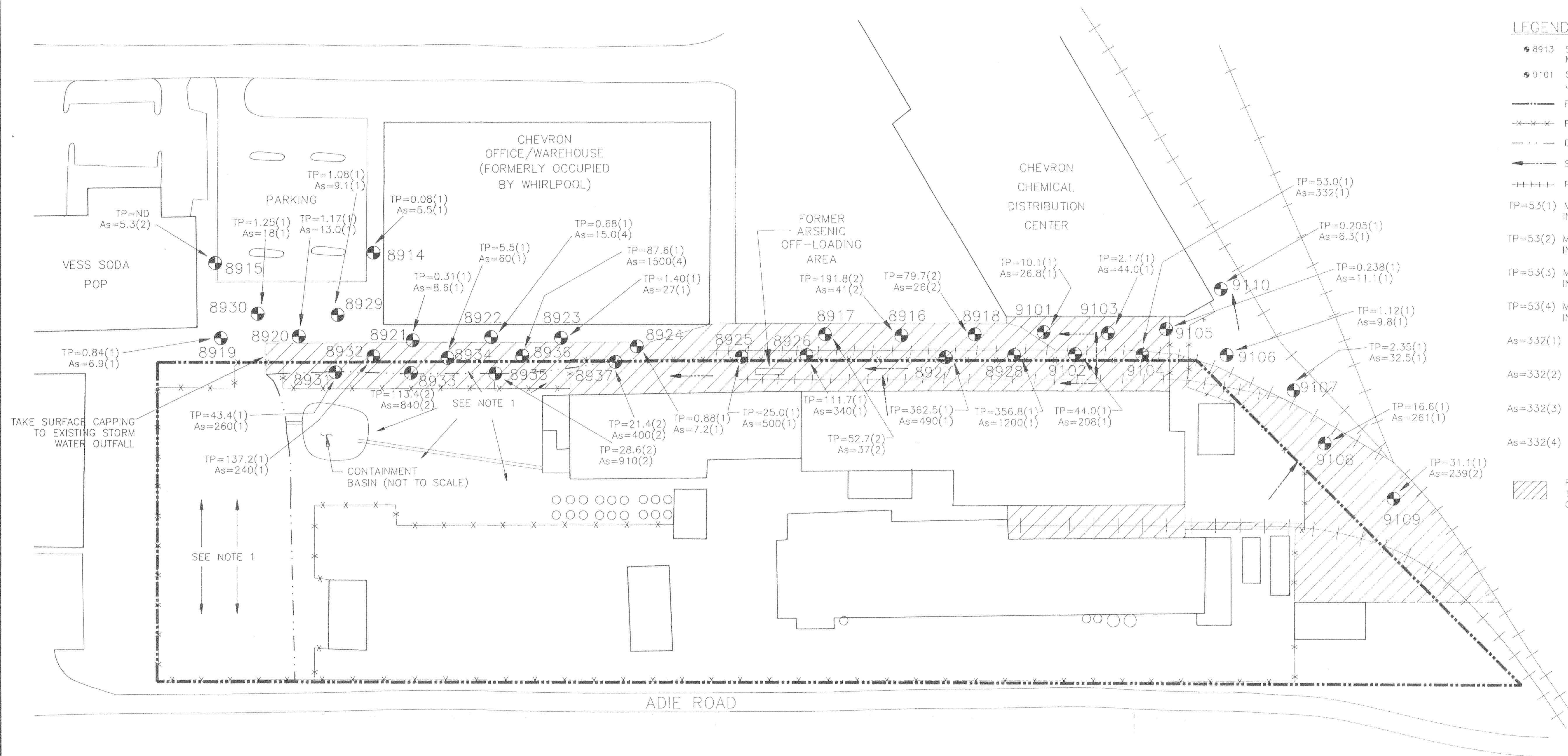
ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI

Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

SITE VICINITY MAP

DRN. BY <i>JLH</i>	DATE <i>4/24/86</i>	PROJECT NO.	FIG. NO.
CHK'D BY <i>YD</i>	DATE <i>7/18/86</i>	13C1147	1





LEGEND:

- 8913 SOIL BORING LOCATIONS
MARCH/APRIL 1989 SAMPLING EVENT
- 9101 SOIL BORING LOCATIONS
JUNE 1991 SAMPLING EVENT
- PROPERTY LINE
- FENCE LINE
- DRAINAGE DITCH (APPROXIMATE LOCATION)
- SURFACE WATER DRAINAGE DIRECTION
- RAILROAD TRACKS
- TP=53(1) MAXIMUM TOTAL PESTICIDES CONCENTRATIONS (mg/kg)
IN BORING WAS IN SAMPLING INTERVAL 0-0.5 FT
- TP=53(2) MAXIMUM TOTAL PESTICIDES CONCENTRATIONS (mg/kg)
IN BORING WAS IN SAMPLING INTERVAL 0.5-2.0 FT
- TP=53(3) MAXIMUM TOTAL PESTICIDES CONCENTRATIONS (mg/kg)
IN BORING WAS IN SAMPLING INTERVAL 2.0-4.0 FT
- TP=53(4) MAXIMUM TOTAL PESTICIDES CONCENTRATIONS (mg/kg)
IN BORING WAS IN SAMPLING INTERVAL 4.0-6.0 FT
- As=332(1) MAXIMUM ARSENIC CONCENTRATION (mg/kg) IN BORING
WAS IN SAMPLING INTERVAL 0-0.5 FT
- As=332(2) MAXIMUM ARSENIC CONCENTRATION (mg/kg) IN BORING
WAS IN SAMPLING INTERVAL 0.5-2.0 FT
- As=332(3) MAXIMUM ARSENIC CONCENTRATION (mg/kg) IN BORING
WAS IN SAMPLING INTERVAL 2.0-4.0 FT
- As=332(4) MAXIMUM ARSENIC CONCENTRATION (mg/kg) IN BORING
WAS IN SAMPLING INTERVAL 4.0-6.0 FT
- REMEDIAL RESPONSE AREA BASED ON HEALTH-BASED
TARGET CONCENTRATIONS FOR ARSENIC AT 127 mg/kg
OR FOR TOTAL PESTICIDES AT 39.2 mg/kg

NOTES

(1) DRAINAGE DITCH IS CURRENTLY BEING REMEDIATED AS
DEFINED IN THE EXISTING REMEDIATION WORK PLANS.



Revision No.	Description	Date	By	App.
2	Modify Remediation Area, Add Surface Drainage	1/24/92	cfp	REB
1	Modify Remediation Areas & Labeling	8/28/91	cfp	

REVISIONS

ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI

OFF-SITE RESPONSE AREAS

Date:	8/15/91	Project Number:	13C114-22	Drawing Number:	3
Drawn by:	kdw	Design by:	cfp	Checked by:	REB 1/30/92

Woodward-Clyde Consultants
CONSULTING ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS



APPENDIX A

1991 SOIL BORING LOGS

DATE 6/21/91 SURFACE ELEVATION, FT _____ DATUM _____ LOCATION See Figure 2

Completion Depth:	<u>6.0 Ft.</u>	Water Depth:	<u>3</u>	ft., After	<u>ATD</u>	hrs.
Project No.:	<u>13C11422</u>			ft., After		hrs.
Project Name:	<u>Ortho-Chevron</u>			ft., After		hrs.
Drilling Contractor:	<u>Woodward-Clyde</u>	Logged by:	<u>C. Pavelka</u>			

LOG of BORING No. 9102

DATE 6/21/91 SURFACE ELEVATION, FT _____ DATUM _____ LOCATION See Figure 2

DEPTH, ft.	SAMPLES			DESCRIPTION	USC	FIELD TESTS			NOTES
	TYPE	REC	SAMPLE			PP, TSF	HEAD SPACE		
							HNU PPM	OVA PPM	
0	S	100		Loose brown TOPSOIL mixed with white crushed limestone ROAD MATERIAL					Sampled with decontaminated shovel
	S	100							Boring advanced with CME-55 and 6 inch diameter HSA
				Firm, dark orange-brown CLAY with limonite nodules and organic mottling					Sampled with 2 or 3 inch split spoon sampler
	S	100		White crushed limestone ROAD MATERIAL with clay and trace of asphalt					
				Firm, orange-brown CLAY with limonite nodules					
	S			With trace organic					
5									
				Bottom of Boring at 6 feet					

Completion Depth: 6.0 Ft.

Water Depth: _____ ft., After _____ hrs.

Project No.: 13C11422

_____ ft., After _____ hrs.

Project Name: Ortho-Chevron

_____ ft., After _____ hrs.

Drilling Contractor: Woodward-ClydeLogged by: C. Pavelka

LOG of BORING No. 9103

DATE 6/21/91 SURFACE ELEVATION, FT _____ DATUM _____ LOCATION See Figure 2

DEPTH, ft.	SAMPLES			DESCRIPTION	USC	FIELD TESTS			NOTES
	TYPE	REC	SAMPLE			PP, TSF	HEAD SPACE		
							HNU PPM	OVA PPM	
0	S	100		Soft brown TOPSOIL with clay and trace of silt					Sampled with a decontaminated shovel Boring advanced with CME-55 and 6 inch diameter HSA Sampled with 2 or 3 inch split spoon sampler
	S	100		Firm, orange-brown CLAY with limonite nodules and organic spotting					
	S	100		Becomes brownish-gray with trace silt					
	S	90		Soft to firm gray, Silty CLAY with orange limonite nodules					
5									
				Bottom of Boring at 6 feet					

Completion Depth: 6.0 Ft.

Water Depth: _____ ft., After _____ hrs.

Project No.: 13C11422

_____ ft., After _____ hrs.

Project Name: Ortho-Chevron

_____ ft., After _____ hrs.

Drilling Contractor: Woodard-ClydeLogged by: C. Pavelka

LOG of BORING No. 9104

DATE 6/21/91 SURFACE ELEVATION, FT _____ DATUM _____ LOCATION See Figure 2

DEPTH, ft.	SAMPLES			DESCRIPTION	USC	FIELD TESTS		NOTES	
	TYPE	REC	SAMPLE			PP, TSF	HEAD SPACE		
							HNU ppm		OVA ppm
0	S	100		Soft, brown TOPSOIL with crushed limestone road material and roots				Sampled with a decontaminated shovel	
	S	100						Boring advanced with CME-55 and 6 inch diameter HSA	
				Firm, orange-brown CLAY with limonite nodules				Sampled with 2 or 3 inch split spoon sampler	
	S	100							
				Soft to firm, gray and orange-brown Silty CLAY with limonite nodules					
	S	100							
5									
				Bottom of Boring at 6 feet					

Completion Depth: 6.0 Ft.

Water Depth: _____ ft., After _____ hrs

Project No.: 13C11422

_____ ft., After _____ hrs.

Project Name: Ortho-Chevron

_____ ft., After _____ hrs.

Drilling Contractor: Woodward-ClydeLogged by: C. Pavelka

LOG of BORING No. 9105

DATE 6/21/91 SURFACE ELEVATION, FT _____ DATUM _____ LOCATION See Figure 2

DEPTH, ft.	SAMPLES			DESCRIPTION	USC	FIELD TESTS			NOTES
	TYPE	REC	SAMPLE			PP, TSF	HEAD SPACE		
							HNU PPM	OVA PPM	
0	S	100		Soft to firm, orange-brown TOPSOIL and CLAY					Sampled with decontaminated shovel Boring advanced with CME-55 and 6 inch diameter Sampled with 2 or 3 inch split spoon sampler
	S	50		Firm, orange-brown CLAY with limonite nodules					
	S	50		With roots and mineral deposit parting					
	S	100		With organic mottling					
5				Soft to firm, brownish gray Silty CLAY with limonite nodules					
				Bottom of Boring at 6 feet					

Completion Depth: 6.0 Ft.

Water Depth: _____ ft., After _____ hrs.

Project No.: 13C11422

_____ ft., After _____ hrs.

Project Name: Ortho-Chevron

_____ ft., After _____ hrs.

Drilling Contractor: Woodward-ClydeLogged by: C. Pavelka

DATE 6/21/91 SURFACE ELEVATION, FT _____ DATUM _____ LOCATION See Figure 2

Completion Depth: <u>6.0 Ft.</u>	Water Depth: _____ ft., After _____ hrs.
Project No.: <u>13C11422</u>	_____ ft., After _____ hrs.
Project Name: <u>Ortho-Chevron</u>	_____ ft., After _____ hrs.
Drilling Contractor: <u>Woodward-Clyde</u>	Logged by: <u>C. Pavelka</u>

LOG of BORING No. 9107

DATE 6/21/91 SURFACE ELEVATION, FT _____ DATUM _____ LOCATION See Figure 2

DEPTH, ft.	SAMPLES			DESCRIPTION	USC	FIELD TESTS		NOTES	
	TYPE	REC	SAMPLE			PP, TSF	HEAD SPACE		
							HNU PPM		OVA PPM
0	S	100		Soft, orange-brown, Clayey TOPSOIL with white crushed road material and roots				Sampled with decontaminated shovel Boring advanced with CME-55 and 6 inch diameter HSA Sampled with 2 or 3 inch split spoon sampler	
	S	67		Firm, orange-brown CLAY with white crushed limestone road material, trace of organic matter					
	S	100		No road material With limonite nodules					
	S	100		Soft to firm, grayish-brown Silty CLAY with limonite nodules					
5									
				Bottom of Boring at 6 feet					

Completion Depth: 6.0 Ft.Water Depth: 4 ft., After ATD hrs.Project No.: 13C11422

_____ ft., After _____ hrs.

Project Name: Ortho-Chevron

_____ ft., After _____ hrs.

Drilling Contractor: Woodward-ClydeLogged by: C. Pavelka

LOG of BORING No. 9108

DATE 6/21/91 SURFACE ELEVATION, FT _____ DATUM _____ LOCATION See Figure 2

Ø DEPTH, ft.	SAMPLES			DESCRIPTION	USC	FIELD TESTS			NOTES
	TYPE	REC	SAMPLE			PP, TSF	HEAD SPACE		
							HNU ppm	OVA ppm	
0	S	100		Soft, orange-brown TOPSOIL with white crushed limestone and asphalt road material					Sampled with decontaminated shovel
	S	100		Firm, orange-brown CLAY with limonite nodules and roots					Boring advanced with CME-55 and 6 inch diameter HSA Sampled with 2 or 3 inch split spoon sampler
	S	100		Soft to firm, gray-brown, Silty CLAY with burrowings and roots					
	S	100		With limonite nodules					
5									
				Bottom of Boring at 6 feet					

Completion Depth: 6.0 Ft.

Water Depth: _____ ft., After _____ hrs.

Project No.: 13C11422

_____ ft., After _____ hrs.

Project Name: Ortho-Chevron

_____ ft., After _____ hrs.

Drilling Contractor: Woodward-ClydeLogged by: C. Pavelka

LOG of BORING No. 9109

Sheet 1 of 1

DATE 6/21/91 SURFACE ELEVATION, FT _____ DATUM _____ LOCATION See Figure 2

DEPTH, ft.	SAMPLES			DESCRIPTION	USC	FIELD TESTS		NOTES	
	TYPE	REC	SAMPLE			PP, TSF	HEAD SPACE		
							HNU PPM		OVA PPM
0	S	100		Soft, brown Topsoil and White crushed limestone and asphalt ROAD MATERIAL				Sampled with decontaminated shovel	
	S	100		Firm, orange-brown CLAY with limonite nodules				Boring advanced with CME-55 and 6 inch diameter HSA Sampled with 2 or 3 inch split spoon sampler	
	S	100		Soft to firm, grayish-brown, Silty CLAY with limonite nodules					
	S	100		Soft to firm, orange-brown CLAY with limonite nodules					
5				Bottom of Boring at 6 feet					

Completion Depth: 6.0 Ft.

Water Depth: _____ ft., After _____ hrs.

Project No.: 13C11422

_____ ft., After _____ hrs.

Project Name: Ortho-Chevron

_____ ft., After _____ hrs.

Drilling Contractor: Woodward-ClydeLogged by: C. Pavelka

Woodward-Clyde Consultants

LOG of BORING No. 9110

DATE 6/21/91 SURFACE ELEVATION, FT _____ DATUM _____ LOCATION See Figure 2

DEPTH, ft.	SAMPLES			DESCRIPTION	USC	FIELD TESTS			NOTES
	TYPE	REC	SAMPLE			PP, TSF	HEAD SPACE		
							HNU PPM	OVA PPM	
0	S	100		Soft, brown, TOPSOIL with clay and roots					Sampled with decontaminated shovel Boring advanced with CME-55 and 6 inch diameter HSA Sampled with 2 or 3 inch spit spoon sampler
	S	100		Soft to firm, orange-brown Silty CLAY					
				Bottom of Boring at 2 feet					
5									

Completion Depth: 2.0 Ft.

Water Depth: _____ ft., After _____ hrs.

Project No.: 13C11422

_____ ft., After _____ hrs.

Project Name: Ortho-Chevron

_____ ft., After _____ hrs.

Drilling Contractor: Woodward-ClydeLogged by: C. Pavelka



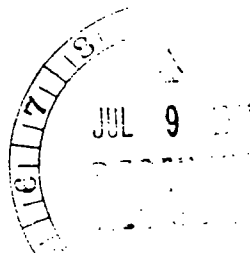
APPENDIX B

LABORATORY ANALYTICAL DATA

ANALYTICAL RESULTS
FOR
WOODWARD-CLYDE CONSULTANTS
ENSECO-RMAL NO. 015510

JULY 8, 1991

Enseco



Reviewed by:

Debbie Fazio
Debbie Fazio

Sue Dalla
Sue Dalla

Introduction

This report presents the analytical results as well as supporting information to aid in the evaluation and interpretation of the data and is arranged in the following order:

- o Sample Description Information
- o Analytical Test Requests
- o Analytical Results
- o Quality Control Report

Each sample was analyzed to achieve the lowest possible reporting limits within the constraints of the method. Due to interferences or high concentrations of target compounds, some samples were diluted and the reporting limits are adjusted relative to the required dilution. In some cases, the extracts had to be diluted to the extent that the surrogates could no longer be calculated for Method 8080.

Sample Description Information

The Sample Description Information lists all of the samples received in this project together with the internal laboratory identification number assigned for each sample. Each project received at Enseco - RMAL is assigned a unique six digit number. Samples within the project are numbered sequentially. The laboratory identification number is a combination of the six digit project code and the sample sequence number.

Also given in the Sample Description Information is the Sample Type (matrix), Date of Sampling (if known) and Date of Receipt at the laboratory.

Analytical Test Requests

The Analytical Test Requests lists the analyses that were performed on each sample. The Custom Test column indicates where tests have been modified to conform to the specific requirements of this project.

SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Time	Received Date
015510-0001-SA	9101-1	SOIL	20 JUN 91	08:15	21 JUN 91
015510-0002-SA	9101-2	SOIL	20 JUN 91	08:25	21 JUN 91
015510-0003-SA	9101-3	SOIL	20 JUN 91	08:25	21 JUN 91
015510-0004-SA	9101-4	SOIL	20 JUN 91	08:45	21 JUN 91
015510-0005-SA	9102-1	SOIL	20 JUN 91	11:30	21 JUN 91
015510-0006-SA	9102-2	SOIL	20 JUN 91	11:40	21 JUN 91
015510-0007-SA	9102-3	SOIL	20 JUN 91	11:50	21 JUN 91
015510-0008-SA	9102-4	SOIL	20 JUN 91	12:00	21 JUN 91
015510-0009-SA	9103-1	SOIL	20 JUN 91	09:05	21 JUN 91
015510-0010-SA	9103-2	SOIL	20 JUN 91	09:15	21 JUN 91
015510-0011-SA	9103-3	SOIL	20 JUN 91	09:25	21 JUN 91
015510-0012-SA	9103-4	SOIL	20 JUN 91	09:35	21 JUN 91
015510-0013-SA	9103-1D	SOIL	20 JUN 91	09:07	21 JUN 91
015510-0014-SA	9103-2D	SOIL	20 JUN 91	09:17	21 JUN 91
015510-0015-SA	9103-3D	SOIL	20 JUN 91	09:27	21 JUN 91
015510-0016-SA	9103-4D	SOIL	20 JUN 91	09:37	21 JUN 91

ANALYTICAL TEST REQUESTS
for
Woodward-Clyde Consultants

Lab ID: 015510	Group Code	Analysis Description	Custom Test?
0001 - 0016	A	Chlorinated Pesticides and PCB's Target Compound List (TCL)	Y
		OCP/PCB Low Level Soils	N
		Chlorinated Pesticides and PCB's Target Compound List (TCL)	N
		Prep - OCP/PCB Medium Level Soils	N
		Arsenic, Furnace AA	N
		Prep - Total Metals, Furnace AA	N
		Prep - Total Metals, Furnace AA	N

Analytical Results

The analytical results for this project are presented in the following data tables. Each data table includes sample identification information, and when available and appropriate, dates sampled, received, authorized, prepared and analyzed. The authorization data is the date when the project was defined by the client such that laboratory work could begin.

Data sheets contain a listing of the parameters measured in each test, the analytical results and the Enseco reporting limit. Reporting limits are adjusted to reflect dilution of the sample, when appropriate. Solid and waste samples are reported on an "as received" basis, i.e. no correction is made for moisture content.

Enseco-RMAL is no longer routinely blank-correcting analytical data. Uncorrected analytical results are reported, along with associated blank results, for all organic and metals analyses. Analytical results and blank results are reported for conventional inorganic parameters as specified in the method. This policy is described in detail in the Enseco Incorporated Quality Assurance Program Plan for Environmental Chemical Monitoring, Revision 3.3, May, 1989.

The results from the Standard Enseco QA/QC Program, which generates data which are independent of matrix effects, is provided subsequently.

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9101-1

Lab ID: 015510-0001-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	340
alpha-BHC	ND	ug/kg	340
beta-BHC	1400	ug/kg	340
delta-BHC	ND	ug/kg	340
gamma-BHC (Lindane)	ND	ug/kg	340
4,4'-DDD	780	ug/kg	660
4,4'-DDE	1600	ug/kg	660
4,4'-DDT	5500	ug/kg	660
Dieldrin	800	ug/kg	660
Heptachlor	ND	ug/kg	340
Chlordane	ND	ug/kg	3400
Surrogate	Recovery		
Dibutyl chlorendate	ND	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9101-2

Lab ID: 015510-0002-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	170
alpha-BHC	ND	ug/kg	170
beta-BHC	540	ug/kg	170
delta-BHC	ND	ug/kg	170
gamma-BHC (Lindane)	ND	ug/kg	170
4,4'-DDD	ND	ug/kg	330
4,4'-DDE	690	ug/kg	330
4,4'-DDT	2400	ug/kg	330
Dieldrin	ND	ug/kg	330
Heptachlor	ND	ug/kg	170
Chlordane	ND	ug/kg	1700
Surrogate	Recovery		
Dibutyl chlorendate	ND	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9101-3

Lab ID: 015510-0003-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	23	ug/kg	1.7
delta-BHC	2.8	ug/kg	1.7
gamma-BHC (Lindane)	2.3	ug/kg	1.7
4,4'-DDD	4.6	ug/kg	3.3
4,4'-DDE	9.9	ug/kg	3.3
4,4'-DDT	17	ug/kg	3.3
Dieldrin	14	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	46	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	89	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9101-4

Lab ID: 015510-0004-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	14	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	3.4	ug/kg	3.3
4,4'-DDT	19	ug/kg	3.3
Dieldrin	6.0	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	ND	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	76	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9102-1

Lab ID: 015510-0005-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1700
alpha-BHC	ND	ug/kg	1700
beta-BHC	ND	ug/kg	1700
delta-BHC	ND	ug/kg	1700
gamma-BHC (Lindane)	ND	ug/kg	1700
4,4'-DDD	ND	ug/kg	3300
4,4'-DDE	8000	ug/kg	3300
4,4'-DDT	36000	ug/kg	3300
Dieldrin	ND	ug/kg	3300
Heptachlor	ND	ug/kg	1700
Chlordane	ND	ug/kg	17000

Surrogate Recovery

Dibutyl chlorendate ND %

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9102-2

Lab ID: 015510-0006-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	680
alpha-BHC	ND	ug/kg	680
beta-BHC	690	ug/kg	680
delta-BHC	ND	ug/kg	680
gamma-BHC (Lindane)	ND	ug/kg	680
4,4'-DDD	ND	ug/kg	1300
4,4'-DDE	2100	ug/kg	1300
4,4'-DDT	8600	ug/kg	1300
Dieldrin	ND	ug/kg	1300
Heptachlor	ND	ug/kg	680
Chlordane	ND	ug/kg	6800
Surrogate	Recovery		
Dibutyl chlorendate	ND	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9102-3

Lab ID: 015510-0007-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	170
alpha-BHC	ND	ug/kg	170
beta-BHC	ND	ug/kg	170
delta-BHC	ND	ug/kg	170
gamma-BHC (Lindane)	ND	ug/kg	170
4,4'-DDD	ND	ug/kg	330
4,4'-DDE	610	ug/kg	330
4,4'-DDT	2900	ug/kg	330
Dieldrin	ND	ug/kg	330
Heptachlor	ND	ug/kg	170
Chlordane	ND	ug/kg	6800

Surrogate

Recovery

Dibutyl chlorendate

ND

%

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9102-4

Lab ID: 015510-0008-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	85
alpha-BHC	ND	ug/kg	85
beta-BHC	ND	ug/kg	85
delta-BHC	ND	ug/kg	85
gamma-BHC (Lindane)	ND	ug/kg	85
4,4'-DDD	ND	ug/kg	160
4,4'-DDE	350	ug/kg	160
4,4'-DDT	1500	ug/kg	160
Dieldrin	ND	ug/kg	160
Heptachlor	ND	ug/kg	85
Chlordane	ND	ug/kg	850
Surrogate	Recovery		
Dibutyl chlorendate	ND	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9103-1

Lab ID: 015510-0009-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	170
alpha-BHC	ND	ug/kg	170
beta-BHC	ND	ug/kg	170
delta-BHC	ND	ug/kg	170
gamma-BHC (Lindane)	ND	ug/kg	170
4,4'-DDD	ND	ug/kg	330
4,4'-DDE	570	ug/kg	330
4,4'-DDT	1600	ug/kg	330
Dieldrin	ND	ug/kg	330
Heptachlor	ND	ug/kg	170
Chlordane	ND	ug/kg	1700

Surrogate Recovery

Dibutyl chlorendate ND %

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9103-2

Lab ID: 015510-0010-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	20	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	ND	ug/kg	3.3
4,4'-DDT	ND	ug/kg	3.3
Dieldrin	22	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	21	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	94	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9103-3

Lab ID: 015510-0011-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	1.8	ug/kg	1.7
beta-BHC	14	ug/kg	1.7
delta-BHC	2.0	ug/kg	1.7
gamma-BHC (Lindane)	2.5	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	3.3	ug/kg	3.3
4,4'-DDT	ND	ug/kg	3.3
Dieldrin	21	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	72	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	91	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9103-4

Lab ID: 015510-0012-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	6.1	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	ND	ug/kg	3.3
4,4'-DDT	ND	ug/kg	3.3
Dieldrin	5.6	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	ND	ug/kg	17

Surrogate

Recovery

Dibutyl chlorendate

87

%

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List -(TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9103-1D

Lab ID: 015510-0013-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	170
alpha-BHC	180	ug/kg	170
beta-BHC	230	ug/kg	170
delta-BHC	ND	ug/kg	170
gamma-BHC (Lindane)	ND	ug/kg	170
4,4'-DDD	ND	ug/kg	330
4,4'-DDE	330	ug/kg	330
4,4'-DDT	910	ug/kg	330
Dieldrin	ND	ug/kg	330
Heptachlor	ND	ug/kg	170
Chlordane	ND	ug/kg	1700
Surrogate	Recovery		
Dibutyl chlorendate	ND	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9103-2D

Lab ID: 015510-0014-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	18	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	ND	ug/kg	3.3
4,4'-DDT	ND	ug/kg	3.3
Dieldrin	14	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	ND	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	86	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9103-3D

Lab ID: 015510-0015-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	12	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	ND	ug/kg	3.3
4,4'-DDT	ND	ug/kg	3.3
Dieldrin	11	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	38	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	93	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9103-4D

Lab ID: 015510-0016-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	7.0	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	ND	ug/kg	3.3
4,4'-DDT	ND	ug/kg	3.3
Dieldrin	6.4	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	ND	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	88	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9101-1

Lab ID: 015510-0001-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	26.8	mg/kg	2.5	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9101-2

Lab ID: 015510-0002-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	7.6	mg/kg	0.50	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
 Client ID: 9101-3
 Lab ID: 015510-0003-SA
 Matrix: SOIL
 Authorized: 21 JUN 91

Sampled: 20 JUN 91
 Prepared: See Below

Received: 21 JUN 91
 Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	5.2	mg/kg	0.50	7060	25 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
 Client ID: 9101-4
 Lab ID: 015510-0004-SA
 Matrix: SOIL
 Authorized: 21 JUN 91

Sampled: 20 JUN 91
 Prepared: See Below

Received: 21 JUN 91
 Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	5.3	mg/kg	0.50	7060	25 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9102-1

Lab ID: 015510-0005-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	208	mg/kg	25.0	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9102-2

Lab ID: 015510-0006-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	20.0	mg/kg	2.5	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9102-3

Lab ID: 015510-0007-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	51.4	mg/kg	5.0	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9102-4

Lab ID: 015510-0008-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	34.1	mg/kg	5.0	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9103-1

Lab ID: 015510-0009-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	44.0	mg/kg	5.0	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9103-2

Lab ID: 015510-0010-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	6.2	mg/kg	0.50	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9103-3

Lab ID: 015510-0011-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	3.6	mg/kg	0.50	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
 Client ID: 9103-4
 Lab ID: 015510-0012-SA
 Matrix: SOIL
 Authorized: 21 JUN 91

Sampled: 20 JUN 91
 Prepared: See Below

Received: 21 JUN 91
 Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	8.0	mg/kg	0.50	7060	25 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
 Client ID: 9103-1D
 Lab ID: 015510-0013-SA
 Matrix: SOIL
 Authorized: 21 JUN 91

Sampled: 20 JUN 91
 Prepared: See Below

Received: 21 JUN 91
 Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	39.0	mg/kg	2.5	7060	25 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9103-2D

Lab ID: 015510-0014-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Reporting Units	Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	7.4	mg/kg	1.0	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9103-3D

Lab ID: 015510-0015-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	8.1	mg/kg	0.50	7060	25 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
 Client ID: 9103-4D
 Lab ID: 015510-0016-SA
 Matrix: SOIL
 Authorized: 21 JUN 91

Sampled: 20 JUN 91
 Prepared: See Below

Received: 21 JUN 91
 Analyzed: See Below

Parameter	Result	Wet wt. Reporting Units	Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	5.6	mg/kg	0.50	7060	25 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Quality Control Results

The Enseco laboratories operate under a vigorous QA/QC program designed to ensure the generation of scientifically valid, legally defensible data by monitoring every aspect of laboratory operations. Routine QA/QC procedures include the use of approved methodologies, independent verification of analytical standards, use of duplicate Laboratory Control Samples to assess the precision and accuracy of the methodology on a routine basis, and a rigorous system of data review.

In addition, the Enseco laboratories maintain a comprehensive set of certifications from both state and federal governmental agencies which require frequent analyses of blind audit samples. Enseco - Rocky Mountain Analytical Laboratory is certified by the EPA under the EPA/CLP program for both Organic and Inorganic analyses, under the USATHAMA (U.S. Army) program, by the Army Corps of Engineers, and the states of Colorado, New Jersey, New York, Utah, and Florida, among others.

The standard laboratory QC package is designed to:

- 1) establish a strong, cost-effective QC program that ensures the generation of scientifically valid, legally defensible data
- 2) assess the laboratory's performance of the analytical method using control limits generated with a well-defined matrix
- 3) establish clear-cut guidelines for acceptability of analytical data so that QC decisions can be made immediately at the bench, and
- 4) provide a standard set of reportables which assures the client of the quality of his data.

The Enseco QC program is based upon monitoring the precision and accuracy of an analytical method by analyzing a set of Duplicate Control Samples (DCS) at frequent, well-defined intervals. Each DCS is a well-characterized matrix which is spiked with target compounds at 5-100 times the reporting limit, depending upon the methodology being monitored. The purpose of the DCS is not to duplicate the sample matrix, but rather to provide an interference-free, homogeneous matrix from which to gather data to establish control limits. These limits are used to determine whether data generated by the laboratory on any given day is in control.

Control limits for accuracy (percent recovery) are based on the average, historical percent recovery +/- 3 standard deviation units. Control limits for precision (relative percent difference) range from 0 (identical duplicate DCS results) to the average, historical relative percent difference + 3 standard deviation units. These control limits are fairly narrow based on the consistency of the matrix being monitored and are updated on a quarterly basis.

For each batch of samples analyzed, an additional control measure is taken in the form of a Single Control Sample (SCS). The SCS consists of a control matrix that is spiked with either representative target compounds or surrogate compounds appropriate to the method being used. An SCS is prepared for each sample lot for which the DCS pair are not analyzed.

Accuracy for DCS and SCS is measured by Percent Recovery.

$$\% \text{ Recovery} = \frac{\text{Measured Concentration}}{\text{Actual Concentration}} \times 100$$

Precision for DCS is measured by Relative Percent Difference (RPD).

$$\text{RPD} = \frac{|\text{Measured Concentration DCS1} - \text{Measured Concentration DCS2}|}{(\text{Measured Concentration DCS1} + \text{Measured Concentration DCS2})/2} \times 100$$

All samples analyzed concurrently by the same test are assigned the same QC lot number. Projects which contain numerous samples, analyzed over several days, may have multiple QC lot numbers associated with each test. The QC information which follows includes a listing of the QC lot numbers associated with each of the samples reported, DCS and SCS (where applicable) recoveries from the QC lots associated with the samples, and control limits for these lots. The QC data is reported by test code, in the order that the tests are reported in the analytical results section of this report.

QC LOT ASSIGNMENT REPORT
Semivolatile Organics by GC

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
015510-0001-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0002-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0003-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0004-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0005-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0006-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0007-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0008-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0009-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0010-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0011-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0012-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0013-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0014-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0015-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B
015510-0016-SA	SOIL	8080-S	24 JUN 91-B	24 JUN 91-B

DUPLICATE CONTROL SAMPLE REPORT
Semivolatile Organics by GC

Analyte	Spiked	Concentration		Measured	AVG	Accuracy		Precision	
		DCS1	DCS2			DCS	Average(%) Limits	(RPD) DCS Limit	Limit
Category: 8080-S									
Matrix: SOIL									
QC Lot: 24 JUN 91-B									
Concentration Units: ug/kg									
gamma-BHC (Lindane)	26.7	21.6	22.5	22.0	83	46-127	4.1	50	
Heptachlor	26.7	21.9	22.9	22.4	84	35-130	4.5	31	
Aldrin	26.7	21.3	22.6	22.0	82	34-132	5.9	43	
Dieldrin	66.7	51.2	53.4	52.3	78	31-134	4.2	38	
Endrin	66.7	57.5	59.9	58.7	88	42-139	4.1	45	
4,4'-DDT	66.7	54.9	57.2	56.0	84	23-134	4.1	50	

Calculations are performed before rounding to avoid round-off errors in calculated results.

SINGLE CONTROL SAMPLE REPORT
Semivolatile Organics by GC

Analyte	Concentration		Accuracy(%)	
	Spiked	Measured	SCS	Limits
Category: 8080-S				
Matrix: SOIL				
QC Lot: 24 JUN 91-B QC Run: 24 JUN 91-B				
Concentration Units: ug/kg				
Dibutyl chlorendate	67.0	65.3	97	20-150

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT
Semivolatile Organics by GC

Analyte	Result	Units	Reporting Limit
Test: 8080CPL-TCL-S			
Matrix: SOIL			
QC Lot: 24 JUN 91-B QC Run: 24 JUN 91-B			
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	ND	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	ND	ug/kg	3.3
4,4'-DDT	ND	ug/kg	3.3
Dieldrin	ND	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	ND	ug/kg	1.7

METHOD BLANK REPORT
Metals Analysis and Preparation

Analyte	Result	Units	Reporting Limit
Test: AS-FAA-S			
Matrix: SOIL			
QC Lot: 25 JUN 91-A QC Run: 25 JUN 91-A			
Arsenic	ND	mg/kg	0.50

CHAIN OF CUSTODY RECORD

SHEET 1 of 7

WOODWARD-CLYDE CONSULTANTS
2318 MILLPARK DR.
MARYLAND HEIGHTS, MISSOURI 63043
314-429-0100

See Attached List for
Analytical Parameters

PROJECT NO: 13C114-22		PROJECT NAME: Ortho-Chevron		NO. OF CONTAINERS	CONTAINER DESCRIPTION / ANALYSES REQUESTED					REMARKS	
SAMPLER'S: (Signature) <i>Cynthia Pavelka</i>											
DATE	TIME	SAMPLE I.D. NUMBER									
			15810		16oz glass Petrol/Glass/Arsenic						
6/20/91	0815	9101-1	01	1	x						
	0825	9101-2	02	1	x						
	0835	9101-3	03	1	x						
	0845	9101-4	04	1	x						
	1130	9102-1	05	1	x						
	1140	9102-2	06	1	x						
	1150	9102-3	07	1	x						
V	1200	9102-4	08	1	x						
<i>RBB 6/20</i>											
RELINQUISHED BY: (Signature) <i>Robert Belton</i>				DATE / TIME 6/20/91		RECEIVED BY: (Signature) <i>Fed Ex</i>				DATE / TIME	
RELINQUISHED BY: (Signature)				DATE / TIME		RECEIVED AT LAB BY: (Signature) <i>Justin Lloyd</i>				DATE / TIME 6/21/91 0800	
METHOD OF SHIPMENT: <i>Fed Express</i>						AIRBILL NO: 0606746700					

CHAIN OF CUSTODY RECORD

SHEET 1 of 1

WOODWARD-CLYDE CONSULTANTS
2318 MILLPARK DR.
MARYLAND HEIGHTS, MISSOURI 63043
314-429-0100

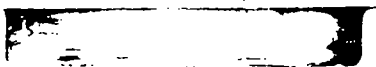
See Attached List
for Analytical Parameters

PROJECT NO: 13C114-22		PROJECT NAME: Ortho-Chevron		CONTAINER NO. OF CONTAINERS	CONTAINER DESCRIPTION / ANALYSES REQUESTED					REMARKS
SAMPLER'S: (Signature) <i>Cynthia Paulk</i>					1602 glass Residuals/Arsenic					
DATE	TIME	SAMPLE I.D. NUMBER								
6/20/91	0905	9103-1	15510	1	X					
	0915	9103-2	10	1	X					
	0925	9103-3	11	1	X					
	0935	9103-4	12	1	X					
	0907	9103-1D	13	1	X					
	0917	9103-2D	14	1	X					
	0927	9103-3D	15	1	X					
✓	0937	9103-4D	16	1	X					
LAB 6/20										
RELINQUISHED BY: (Signature) <i>Robert Bellum</i>				DATE / TIME 6/20/91		RECEIVED BY: (Signature) Fed Ex			DATE / TIME	
RELINQUISHED BY: (Signature)				DATE / TIME		RECEIVED AT LAB BY: (Signature) <i>Justin Chappel</i>			DATE / TIME 6/21/91 0900	
METHOD OF SHIPMENT: Fed Express						AIRBILL NO: 0606746700				

June 1991 Off-site (north)
Soil sampling

Enseco Incorporated

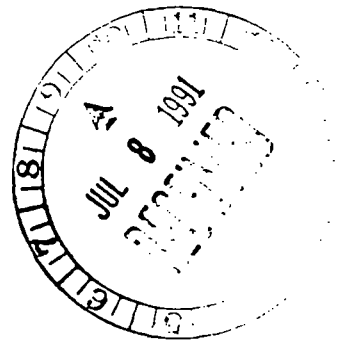
13C114-22 File 6.1.5



Enseco
A CORNING Company



Enseco
A CORNING Company



July 5, 1991

Mr. Dave Convy
Woodward-Clyde Consultants
5055 Antioch Road
Overland Park, KS 66203

Dear Mr. Convy:

Enclosed is the report for 16 soil samples received at Enseco-Rocky Mountain Analytical Laboratory on June 21, 1991.

Included with the report is a quality control summary.

Please call if you have any questions.

Sincerely,

Debbie Fazio
Debbie Fazio
Program Administrator

Reviewed by:

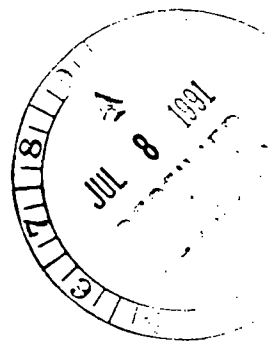
Sue Dalla
Sue Dalla
Manager
Program Administration

DF/SD/dmh
Enclosures

RMAL #015509

ANALYTICAL RESULTS
FOR
WOODWARD-CLYDE CONSULTANTS
ENSECO-RMAL NO. 015509

JULY 5, 1991



Reviewed by:

Debbie Fazio
Debbie Fazio

Sue Dalla
Sue Dalla

Introduction

This report presents the analytical results as well as supporting information to aid in the evaluation and interpretation of the data and is arranged in the following order:

- o Sample Description Information
- o Analytical Test Requests
- o Analytical Results
- o Quality Control Report

All analyses at Enseco are performed so that the maximum concentration of sample consistent with the method is analyzed. Dilutions are at times required to avoid saturation of the detector, to achieve linearity for a specific target compound or to reduce matrix interferences. In this event, reporting limits are adjusted proportionately. Surrogate compounds may not be measurable in samples which have been diluted.

Samples 015509-0001 through -0005, -0007, -0009 through -0013, and -0015 by Method 8080 were diluted due to elevated concentrations of target compounds. The reporting limits were raised proportionately. Due to dilutions, the surrogates were not recovered for samples 015509-0001, -0002, -0009, -0013, and -0015.

Sample Description Information

The Sample Description Information lists all of the samples received in this project together with the internal laboratory identification number assigned for each sample. Each project received at Enseco - RMAL is assigned a unique six digit number. Samples within the project are numbered sequentially. The laboratory identification number is a combination of the six digit project code and the sample sequence number.

Also given in the Sample Description Information is the Sample Type (matrix), Date of Sampling (if known) and Date of Receipt at the laboratory.

Analytical Test Requests

The Analytical Test Requests lists the analyses that were performed on each sample. The Custom Test column indicates where tests have been modified to conform to the specific requirements of this project.

SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Time	Received Date
015509-0001-SA	9104-1	SOIL	20 JUN 91	10:50	21 JUN 91
015509-0002-SA	9104-2	SOIL	20 JUN 91	10:50	21 JUN 91
015509-0003-SA	9104-3	SOIL	20 JUN 91	10:50	21 JUN 91
015509-0004-SA	9104-4	SOIL	20 JUN 91	10:50	21 JUN 91
015509-0005-SA	9105-1	SOIL	20 JUN 91	10:00	21 JUN 91
015509-0006-SA	9105-2	SOIL	20 JUN 91	10:10	21 JUN 91
015509-0007-SA	9106-1	SOIL	20 JUN 91	14:20	21 JUN 91
015509-0008-SA	9106-2	SOIL	20 JUN 91	14:20	21 JUN 91
015509-0009-SA	9107-1	SOIL	20 JUN 91	14:45	21 JUN 91
015509-0010-SA	9107-2	SOIL	20 JUN 91	14:45	21 JUN 91
015509-0011-SA	9110-1	SOIL	20 JUN 91	14:00	21 JUN 91
015509-0012-SA	9110-2	SOIL	20 JUN 91	14:00	21 JUN 91
015509-0013-SA	9108-1	SOIL	20 JUN 91	16:00	21 JUN 91
015509-0014-SA	9108-2	SOIL	20 JUN 91	16:00	21 JUN 91
015509-0015-SA	9109-1	SOIL	20 JUN 91	16:30	21 JUN 91
015509-0016-SA	9109-2	SOIL	20 JUN 91	16:30	21 JUN 91

ANALYTICAL TEST REQUESTS
for
Woodward-Clyde Consultants

Lab ID: 015509	Group Code	Analysis Description	Custom Test?
0001 - 0016	A	Chlorinated Pesticides and PCB's Target Compound List (TCL)	Y
		OCP/PCB Low Level Soils	N
		Chlorinated Pesticides and PCB's Target Compound List (TCL)	N
		Prep - OCP/PCB Medium Level Soils	N
		Arsenic, Furnace AA	N
		Prep - Total Metals, Furnace AA	N
		Prep - Total Metals, Furnace AA	N

Analytical Results

The analytical results for this project are presented in the following data tables. Each data table includes sample identification information, and when available and appropriate, dates sampled, received, authorized, prepared and analyzed. The authorization data is the date when the project was defined by the client such that laboratory work could begin.

Data sheets contain a listing of the parameters measured in each test, the analytical results and the Enseco reporting limit. Reporting limits are adjusted to reflect dilution of the sample, when appropriate. Solid and waste samples are reported on an "as received" basis, i.e. no correction is made for moisture content.

Enseco-RMAL is no longer routinely blank-correcting analytical data. Uncorrected analytical results are reported, along with associated blank results, for all organic and metals analyses. Analytical results and blank results are reported for conventional inorganic parameters as specified in the method. This policy is described in detail in the Enseco Incorporated Quality Assurance Program Plan for Environmental Chemical Monitoring, Revision 3.3, May, 1989.

The results from the Standard Enseco QA/QC Program, which generates data which are independent of matrix effects, is provided subsequently.

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9104-1

Lab ID: 015509-0001-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 29 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	17000
alpha-BHC	ND	ug/kg	17000
beta-BHC	ND	ug/kg	17000
delta-BHC	ND	ug/kg	17000
gamma-BHC (Lindane)	ND	ug/kg	17000
4,4'-DDD	ND	ug/kg	33000
4,4'-DDE	ND	ug/kg	33000
4,4'-DDT	53000	ug/kg	33000
Dieldrin	ND	ug/kg	33000
Heptachlor	ND	ug/kg	17000
Chlordane	ND	ug/kg	170000
Surrogate	Recovery		
Dibutyl chlorendate	ND	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
 Target Compound List (TCL)
 Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9104-2

Lab ID: 015509-0002-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 29 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1700
alpha-BHC	ND	ug/kg	1700
beta-BHC	3700	ug/kg	1700
delta-BHC	ND	ug/kg	1700
gamma-BHC (Lindane)	ND	ug/kg	1700
4,4'-DDD	ND	ug/kg	3300
4,4'-DDE	3300	ug/kg	3300
4,4'-DDT	18000	ug/kg	3300
Dieldrin	ND	ug/kg	3300
Heptachlor	ND	ug/kg	1700
Chlordane	ND	ug/kg	17000
Surrogate	Recovery		
Dibutyl chlorendate	ND	%	

ND = Not detected
 NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants
Client ID: 9104-3
Lab ID: 015509-0003-SA
Matrix: SOIL
Authorized: 21 JUN 91

Sampled: 20 JUN 91
Prepared: 24 JUN 91

Received: 21 JUN 91
Analyzed: 29 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	34
alpha-BHC	ND	ug/kg	34
beta-BHC	68	ug/kg	34
delta-BHC	ND	ug/kg	34
gamma-BHC (Lindane)	ND	ug/kg	34
4,4'-DDD	ND	ug/kg	66
4,4'-DDE	ND	ug/kg	66
4,4'-DDT	370	ug/kg	66
Dieldrin	ND	ug/kg	66
Heptachlor	ND	ug/kg	34
Chlordane	ND	ug/kg	340
Surrogate	Recovery		
Dibutyl chlorendate	113	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9104-4

Lab ID: 015509-0004-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 29 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	34
alpha-BHC	ND	ug/kg	34
beta-BHC	89	ug/kg	34
delta-BHC	ND	ug/kg	34
gamma-BHC (Lindane)	ND	ug/kg	34
4,4'-DDD	ND	ug/kg	66
4,4'-DDE	110	ug/kg	66
4,4'-DDT	500	ug/kg	66
Dieldrin	ND	ug/kg	66
Heptachlor	ND	ug/kg	34
Chlordane	ND	ug/kg	340
Surrogate	Recovery		
Dibutyl chlorendate	112	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants
Client ID: 9105-1
Lab ID: 015509-0005-SA
Matrix: SOIL
Authorized: 21 JUN 91

Sampled: 20 JUN 91
Prepared: 24 JUN 91

Received: 21 JUN 91
Analyzed: 29 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	17
alpha-BHC	ND	ug/kg	17
beta-BHC	ND	ug/kg	17
delta-BHC	ND	ug/kg	17
gamma-BHC (Lindane)	ND	ug/kg	17
4,4'-DDD	ND	ug/kg	33
4,4'-DDE	100	ug/kg	33
4,4'-DDT	100	ug/kg	33
Dieldrin	38	ug/kg	33
Heptachlor	ND	ug/kg	17
Chlordane	ND	ug/kg	170
Surrogate	Recovery		
Dibutyl chlorendate	101	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9105-2

Lab ID: 015509-0006-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 29 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	2.2	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDO	ND	ug/kg	3.3
4,4'-DDE	8.1	ug/kg	3.3
4,4'-DDT	9.2	ug/kg	3.3
Dieldrin	4.3	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	ND	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	91	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9106-1

Lab ID: 015509-0007-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 29 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	68
alpha-BHC	ND	ug/kg	68
beta-BHC	ND	ug/kg	68
delta-BHC	ND	ug/kg	68
gamma-BHC (Lindane)	ND	ug/kg	68
4,4'-DDD	ND	ug/kg	130
4,4'-DDE	310	ug/kg	130
4,4'-DDT	810	ug/kg	130
Dieldrin	ND	ug/kg	130
Heptachlor	ND	ug/kg	68
Chlordane	ND	ug/kg	680
Surrogate	Recovery		
Dibutyl chlorendate	109	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9106-2

Lab ID: 015509-0008-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 29 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	7.4	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	ND	ug/kg	3.3
4,4'-DDT	ND	ug/kg	3.3
Dieldrin	4.9	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	ND	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	87	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9107-1

Lab ID: 015509-0009-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 01 JUL 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	170
alpha-BHC	ND	ug/kg	170
beta-BHC	ND	ug/kg	170
delta-BHC	ND	ug/kg	170
gamma-BHC (Lindane)	ND	ug/kg	170
4,4'-DDD	ND	ug/kg	330
4,4'-DDE	450	ug/kg	330
4,4'-DDT	1900	ug/kg	330
Dieldrin	ND	ug/kg	330
Heptachlor	ND	ug/kg	170
Chlordane	ND	ug/kg	1700
Surrogate	Recovery		
Dibutyl chlorendate	ND	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9107-2

Lab ID: 015509-0010-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 29 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	68
alpha-BHC	ND	ug/kg	68
beta-BHC	ND	ug/kg	68
delta-BHC	ND	ug/kg	68
gamma-BHC (Lindane)	ND	ug/kg	68
4,4'-DDD	ND	ug/kg	130
4,4'-DDE	250	ug/kg	130
4,4'-DDT	650	ug/kg	130
Dieldrin	ND	ug/kg	130
Heptachlor	ND	ug/kg	68
Chlordane	ND	ug/kg	680
Surrogate	Recovery		
Dibutyl chlorendate	110	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9110-1

Lab ID: 015509-0011-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 29 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	17
alpha-BHC	ND	ug/kg	17
beta-BHC	ND	ug/kg	17
delta-BHC	ND	ug/kg	17
gamma-BHC (Lindane)	ND	ug/kg	17
4,4'-DDD	ND	ug/kg	33
4,4'-DDE	45	ug/kg	33
4,4'-DDT	160	ug/kg	33
Dieldrin	ND	ug/kg	33
Heptachlor	ND	ug/kg	17
Chlordane	ND	ug/kg	170
Surrogate	Recovery		
Dibutyl chlorendate	83	%	

ND = Not detected

NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants
Client ID: 9110-2
Lab ID: 015509-0012-SA
Matrix: SOIL
Authorized: 21 JUN 91

Sampled: 20 JUN 91
Prepared: 24 JUN 91

Received: 21 JUN 91
Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	3.4
alpha-BHC	ND	ug/kg	3.4
beta-BHC	ND	ug/kg	3.4
delta-BHC	ND	ug/kg	3.4
gamma-BHC (Lindane)	ND	ug/kg	3.4
4,4'-DDD	ND	ug/kg	6.6
4,4'-DDE	13	ug/kg	6.6
4,4'-DDT	45	ug/kg	6.6
Dieldrin	ND	ug/kg	6.6
Heptachlor	ND	ug/kg	3.4
Chlordane	ND	ug/kg	34
Surrogate	Recovery		
Dibutyl chlorendate	76	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9108-1

Lab ID: 015509-0013-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1700
alpha-BHC	ND	ug/kg	1700
beta-BHC	ND	ug/kg	1700
delta-BHC	ND	ug/kg	1700
gamma-BHC (Lindane)	ND	ug/kg	1700
4,4'-DDD	ND	ug/kg	3300
4,4'-DDE	4600	ug/kg	3300
4,4'-DDT	12000	ug/kg	3300
Dieldrin	ND	ug/kg	3300
Heptachlor	ND	ug/kg	1700
Chlordane	ND	ug/kg	17000
Surrogate	Recovery		
Dibutyl chlorendate	ND	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9108-2

Lab ID: 015509-0014-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	ND	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	6.2	ug/kg	3.3
4,4'-DDT	6.5	ug/kg	3.3
Dieldrin	9.2	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	ND	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	76	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Client Name: Woodward-Clyde Consultants

Client ID: 9109-1

Lab ID: 015509-0015-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1700
alpha-BHC	ND	ug/kg	1700
beta-BHC	ND	ug/kg	1700
delta-BHC	ND	ug/kg	1700
gamma-BHC (Lindane)	ND	ug/kg	1700
4,4'-DDD	3900	ug/kg	3300
4,4'-DDE	5200	ug/kg	3300
4,4'-DDT	22000	ug/kg	3300
Dieldrin	ND	ug/kg	3300
Heptachlor	ND	ug/kg	1700
Chlordane	ND	ug/kg	17000
Surrogate	Recovery		
Dibutyl chlorendate	ND	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Chlorinated Pesticides and PCB's
Target Compound List (TCL)
Method 8080

Enseco
A Corning Company

Client Name: Woodward-Clyde Consultants

Client ID: 9109-2

Lab ID: 015509-0016-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: 24 JUN 91

Received: 21 JUN 91

Analyzed: 30 JUN 91

Parameter	Result	Wet wt. Units	Reporting Limit
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	ND	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	6.1	ug/kg	3.3
4,4'-DDT	13	ug/kg	3.3
Dieldrin	ND	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	ND	ug/kg	17
Surrogate	Recovery		
Dibutyl chlorendate	85	%	

ND = Not detected
NA = Not applicable

Reported By: Houa Vue

Approved By: Mike Hoffman

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9104-1

Lab ID: 015509-0001-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	332	mg/kg	25.0	7060	22 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9104-2

Lab ID: 015509-0002-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Reporting Units	Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	111	mg/kg	10.0	7060	22 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9104-3

Lab ID: 015509-0003-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	14.2	mg/kg	2.5	7060	22 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
 Client ID: 9104-4
 Lab ID: 015509-0004-SA
 Matrix: SOIL
 Authorized: 21 JUN 91

Sampled: 20 JUN 91
 Prepared: See Below

Received: 21 JUN 91
 Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	17.5	mg/kg	2.5	7060	22 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9105-1

Lab ID: 015509-0005-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	11.1	mg/kg	2.5	7060	22 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals**Total Metals**

Client Name: Woodward-Clyde Consultants

Client ID: 9105-2

Lab ID: 015509-0006-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	7.2	mg/kg	0.50	7060	22 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Sandra Jones

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9106-1

Lab ID: 015509-0007-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	9.8	mg/kg	2.5	7060	22 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
 Client ID: 9106-2
 Lab ID: 015509-0008-SA
 Matrix: SOIL
 Authorized: 21 JUN 91

Sampled: 20 JUN 91
 Prepared: See Below

Received: 21 JUN 91
 Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	6.6	mg/kg	0.50	7060	22 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Sandra Jones

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
 Client ID: 9107-1
 Lab ID: 015509-0009-SA
 Matrix: SOIL
 Authorized: 21 JUN 91

Sampled: 20 JUN 91
 Prepared: See Below

Received: 21 JUN 91
 Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	32.5	mg/kg	5.0	7060	22 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9107-2

Lab ID: 015509-0010-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	26.1	mg/kg	5.0	7060	22 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9110-1

Lab ID: 015509-0011-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	6.3	mg/kg	1.0	7060	22 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9110-2

Lab ID: 015509-0012-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	4.3	mg/kg	0.50	7060	22 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9108-1

Lab ID: 015509-0013-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	261	mg/kg	25.0	7060	22 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
 Client ID: 9108-2
 Lab ID: 015509-0014-SA
 Matrix: SOIL
 Authorized: 21 JUN 91

Sampled: 20 JUN 91
 Prepared: See Below

Received: 21 JUN 91
 Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	64.2	mg/kg	10.0	7060	22 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9109-1

Lab ID: 015509-0015-SA

Matrix: SOIL

Authorized: 21 JUN 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 21 JUN 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	160	mg/kg	50.0	7060	22 JUN 91	26 JUN 91

ND = Not detected
NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants
 Client ID: 9109-2
 Lab ID: 015509-0016-SA
 Matrix: SOIL
 Authorized: 21 JUN 91

Sampled: 20 JUN 91
 Prepared: See Below

Received: 21 JUN 91
 Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	239	mg/kg	50.0	7060	22 JUN 91	26 JUN 91

ND = Not detected
 NA = Not applicable

Reported By: Bill McCall

Approved By: Sandra Jones

Quality Control Results

The Enseco laboratories operate under a vigorous QA/QC program designed to ensure the generation of scientifically valid, legally defensible data by monitoring every aspect of laboratory operations. Routine QA/QC procedures include the use of approved methodologies, independent verification of analytical standards, use of duplicate Laboratory Control Samples to assess the precision and accuracy of the methodology on a routine basis, and a rigorous system of data review.

In addition, the Enseco laboratories maintain a comprehensive set of certifications from both state and federal governmental agencies which require frequent analyses of blind audit samples. Enseco - Rocky Mountain Analytical Laboratory is certified by the EPA under the EPA/CLP program for both Organic and Inorganic analyses, under the USATHAMA (U.S. Army) program, by the Army Corps of Engineers, and the states of Colorado, New Jersey, New York, Utah, and Florida, among others.

The standard laboratory QC package is designed to:

- 1) establish a strong, cost-effective QC program that ensures the generation of scientifically valid, legally defensible data
- 2) assess the laboratory's performance of the analytical method using control limits generated with a well-defined matrix
- 3) establish clear-cut guidelines for acceptability of analytical data so that QC decisions can be made immediately at the bench, and
- 4) provide a standard set of reportables which assures the client of the quality of his data.

The Enseco QC program is based upon monitoring the precision and accuracy of an analytical method by analyzing a set of Duplicate Control Samples (DCS) at frequent, well-defined intervals. Each DCS is a well-characterized matrix which is spiked with target compounds at 5-100 times the reporting limit, depending upon the methodology being monitored. The purpose of the DCS is not to duplicate the sample matrix, but rather to provide an interference-free, homogeneous matrix from which to gather data to establish control limits. These limits are used to determine whether data generated by the laboratory on any given day is in control.

Control limits for accuracy (percent recovery) are based on the average, historical percent recovery +/- 3 standard deviation units. Control limits for precision (relative percent difference) range from 0 (identical duplicate DCS results) to the average, historical relative percent difference + 3 standard deviation units. These control limits are fairly narrow based on the consistency of the matrix being monitored and are updated on a quarterly basis.

For each batch of samples analyzed, an additional control measure is taken in the form of a Single Control Sample (SCS). The SCS consists of a control matrix that is spiked with either representative target compounds or surrogate compounds appropriate to the method being used. An SCS is prepared for each sample lot for which the DCS pair are not analyzed.

Accuracy for DCS and SCS is measured by Percent Recovery.

$$\% \text{ Recovery} = \frac{\text{Measured Concentration}}{\text{Actual Concentration}} \times 100$$

Precision for DCS is measured by Relative Percent Difference (RPD).

$$\text{RPD} = \frac{|\text{Measured Concentration DCS1} - \text{Measured Concentration DCS2}|}{(\text{Measured Concentration DCS1} + \text{Measured Concentration DCS2})/2} \times 100$$

All samples analyzed concurrently by the same test are assigned the same QC lot number. Projects which contain numerous samples, analyzed over several days, may have multiple QC lot numbers associated with each test. The QC information which follows includes a listing of the QC lot numbers associated with each of the samples reported, DCS and SCS (where applicable) recoveries from the QC lots associated with the samples, and control limits for these lots. The QC data is reported by test code, in the order that the tests are reported in the analytical results section of this report.

QC LOT ASSIGNMENT REPORT
Semivolatile Organics by GC

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
015509-0001-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0002-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0003-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0004-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0005-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0006-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0007-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0008-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0009-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0010-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0011-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0012-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0013-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0014-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0015-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A
015509-0016-SA	SOIL	8080-S	24 JUN 91-A	24 JUN 91-A

DUPLICATE CONTROL SAMPLE REPORT
Semivolatile Organics by GC

Analyte	Spiked	Concentration		Measured DCS2	AVG	Accuracy Average(%)		Precision (RPD)	
		DCS1				DCS	Limits	DCS	Limit
Category: 8080-S									
Matrix: SOIL									
QC Lot: 24 JUN 91-A									
Concentration Units: ug/kg									
gamma-BHC (Lindane)	26.7	22.3		22.2	22.2	83	46-127	0.4	50
Heptachlor	26.7	22.9		22.7	22.8	85	35-130	0.9	31
Aldrin	26.7	22.3		22.3	22.3	84	34-132	0.0	43
Dieldrin	66.7	53.2		52.3	52.8	79	31-134	1.7	38
Endrin	66.7	60.5		59.0	59.8	90	42-139	2.5	45
4,4'-DDT	66.7	57.0		54.8	55.9	84	23-134	3.9	50

Calculations are performed before rounding to avoid round-off errors in calculated results.

SINGLE CONTROL SAMPLE REPORT
Semivolatile Organics by GC

Analyte	Concentration		Accuracy(%)	
	Spiked	Measured	SCS	Limits
Category: 8080-S				
Matrix: SOIL				
QC Lot: 24 JUN 91-A QC Run: 24 JUN 91-A				
Concentration Units: ug/kg				
Dibutyl chlorendate	67.0	62.5	93	20-150

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT
Semivolatile Organics by GC

Analyte	Result	Units	Reporting Limit
Test: 8080CPL-TCL-S			
Matrix: SOIL			
QC Lot: 24 JUN 91-A QC Run: 24 JUN 91-A			
Aldrin	ND	ug/kg	1.7
alpha-BHC	ND	ug/kg	1.7
beta-BHC	ND	ug/kg	1.7
delta-BHC	ND	ug/kg	1.7
gamma-BHC (Lindane)	ND	ug/kg	1.7
4,4'-DDD	ND	ug/kg	3.3
4,4'-DDE	ND	ug/kg	3.3
4,4'-DDT	ND	ug/kg	3.3
Dieldrin	ND	ug/kg	3.3
Heptachlor	ND	ug/kg	1.7
Chlordane	ND	ug/kg	17

QC LOT ASSIGNMENT REPORT
Metals Analysis and Preparation

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
015509-0001-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0002-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0003-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0004-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0005-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0006-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0007-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0008-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0009-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0010-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0011-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0012-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0013-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0014-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0015-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L
015509-0016-SA	SOIL	AS-FAA-S	22 JUN 91-L	22 JUN 91-L

DUPLICATE CONTROL SAMPLE REPORT
Metals Analysis and Preparation

Analyte	Concentration Spiked	Measured		AVG	Accuracy Average(%)		Precision (RPD)	
		DCS1	DCS2		DCS	Limits	DCS	Limit
Category: AS-FAA-S								
Matrix: SOIL								
QC Lot: 22 JUN 91-L								
Concentration Units: mg/Kg								
Arsenic	3.0	3.03	3.02	3.02	101	75-125	0.3	20

Calculations are performed before rounding to avoid round-off errors in calculated results.

Appendix

CHAIN OF CUSTODY RECORD

SHEET 2 of 1

WOODWARD-CLYDE CONSULTANTS
2318 MILLPARK DR.
MARYLAND HEIGHTS, MISSOURI 63043
314-429-0100

See Attached List
for Analytical Parameters

PROJECT NO:		PROJECT NAME:		NO. OF CONTAINERS	CONTAINER DESCRIPTION / ANALYSES REQUESTED					REMARKS
13C114-22		Ortho-Chevron			16oz glass bottles/arsenic					
SAMPLER'S: (Signature) <i>Cynthia Powell</i>										
DATE	TIME	SAMPLE I.D. NUMBER	Run #							
6/2/91	1050	9104-1	01	1	X					
	1050	9104-2	02	1	X					
	1050	9104-3	03	1	X					
	1050	9104-4	04	1	X					
	1000	9105-1	05	1	X					
	1010	9105-2	06	1	X					
	2:20pm	9106-1	07	1	X					
	2:20pm	9106-2	08	1	X					
RBB 6/20/91										
RELINQUISHED BY: (Signature) <i>Robert Bellman</i>				DATE / TIME 6/20/91		RECEIVED BY: (Signature) <i>Fcd Ex</i>			DATE / TIME	
RELINQUISHED BY: (Signature)				DATE / TIME		RECEIVED AT LAB BY: (Signature) <i>Justin Chapple</i>			DATE / TIME 6/21/91	
METHOD OF SHIPMENT: fcd express					AIRBILL NO: 0606746700					

CHAIN OF CUSTODY RECORD

SHEET 1 of 1

WOODWARD-CLYDE CONSULTANTS
2318 MILLPARK DR.
MARYLAND HEIGHTS, MISSOURI 63043
314-429-0100

See Attached List
for Analytical Parameters

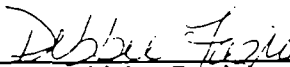
PROJECT NO:		PROJECT NAME:		NO. OF CONTAINERS	CONTAINER DESCRIPTION / ANALYSES REQUESTED					REMARKS
130114-22		Ortho-Chevron			1600 g/loss Pesticides/Asenics					
SAMPLER'S: (Signature) <i>Cynthia Pavelka</i>										
DATE	TIME	SAMPLE I.D. NUMBER		MAF# 5509						
6/20/91	2:45 PM	9107-1		09	1	X				
	2:45	9107-2		10	1	X				
	2:00	9110-1		11	1	X				
	2:00	9110-2		12	1	X				
	4:00	9108-1		13	1	X				
	4:00	9109 9108-2		14	1	X				
	4:30	9109-1		15	1	X				
✓	4:30	9109-2		16	1	X				
ABB 6/20										
RELINQUISHED BY: (Signature) <i>Robert Bellman</i>					DATE / TIME 6/20/91		RECEIVED BY: (Signature) FED EX			DATE / TIME
RELINQUISHED BY: (Signature)					DATE / TIME		RECEIVED AT LAB BY: (Signature) <i>Justin Chappell</i>			DATE / TIME 6/21/91 0800
METHOD OF SHIPMENT: FED Express					AIRBILL NO: 0606746700					

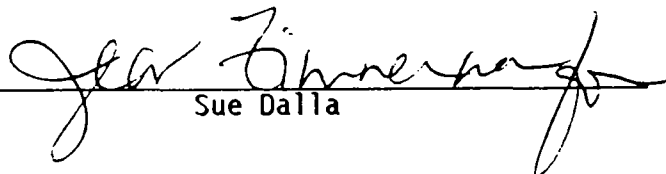
ANALYTICAL RESULTS
FOR
WOODWARD-CLYDE CONSULTANTS
ENSECO-RMAL NO. 015942

Enseco

JULY 25, 1991

Reviewed by:


Debbie Fazio


Sue Dalla

Introduction

This report presents the analytical results as well as supporting information to aid in the evaluation and interpretation of the data and is arranged in the following order:

- o Sample Description Information
- o Analytical Test Requests
- o Analytical Results
- o Quality Control Report

Sample Description Information

The Sample Description Information lists all of the samples received in this project together with the internal laboratory identification number assigned for each sample. Each project received at Enseco - RMAL is assigned a unique six digit number. Samples within the project are numbered sequentially. The laboratory identification number is a combination of the six digit project code and the sample sequence number.

Also given in the Sample Description Information is the Sample Type (matrix), Date of Sampling (if known) and Date of Receipt at the laboratory.

Analytical Test Requests

The Analytical Test Requests lists the analyses that were performed on each sample. The Custom Test column indicates where tests have been modified to conform to the specific requirements of this project.

SAMPLE DESCRIPTION INFORMATION
for
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled		Received
			Date	Time	
015942-0001-SA	9108-3	SOIL	20 JUN 91	16:00	23 JUL 91
015942-0002-SA	9108-4	SOIL	20 JUN 91	16:00	23 JUL 91
015942-0003-SA	9109-3	SOIL	20 JUN 91	16:30	23 JUL 91
015942-0004-SA	9109-4	SOIL	20 JUN 91	16:30	23 JUL 91

ANALYTICAL TEST REQUESTS
for
Woodward-Clyde Consultants

Lab ID: 015942	Group Code	Analysis Description	Custom Test?
0001 - 0004	A	Arsenic, Furnace AA	N
		Prep - Total Metals, Furnace AA	N
		Prep - Total Metals, Furnace AA	N

Analytical Results

The analytical results for this project are presented in the following data tables. Each data table includes sample identification information, and when available and appropriate, dates sampled, received, authorized, prepared and analyzed. The authorization data is the date when the project was defined by the client such that laboratory work could begin.

Data sheets contain a listing of the parameters measured in each test, the analytical results and the Enseco reporting limit. Reporting limits are adjusted to reflect dilution of the sample, when appropriate. Solid and waste samples are reported on an "as received" basis, i.e. no correction is made for moisture content.

Enseco-RMAL is no longer routinely blank-correcting analytical data. Uncorrected analytical results are reported, along with associated blank results, for all organic and metals analyses. Analytical results and blank results are reported for conventional inorganic parameters as specified in the method. This policy is described in detail in the Enseco Incorporated Quality Assurance Program Plan for Environmental Chemical Monitoring, Revision 3.3, May, 1989.

The results from the Standard Enseco QA/QC Program, which generates data which are independent of matrix effects, is provided subsequently.

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9108-3

Lab ID: 015942-0001-SA

Matrix: SOIL

Authorized: 23 JUL 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 23 JUL 91

Analyzed: See Below

Parameter	Result	Wet wt. Reporting Units	Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	19.2	mg/kg	5.0	7060	24 JUL 91	24 JUL 91

ND = Not detected
NA = Not applicable

Reported By: David Patterson

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9108-4

Lab ID: 015942-0002-SA

Matrix: SOIL

Authorized: 23 JUL 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 23 JUL 91

Analyzed: See Below

Parameter	Result	Wet wt. Reporting Units	Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	27.9	mg/kg	5.0	7060	24 JUL 91	24 JUL 91

ND = Not detected
NA = Not applicable

Reported By: David Patterson

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9109-3

Lab ID: 015942-0003-SA

Matrix: SOIL

Authorized: 23 JUL 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 23 JUL 91

Analyzed: See Below

Parameter	Result	Wet wt. Reporting Units	Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	54.9	mg/kg	5.0	7060	24 JUL 91	24 JUL 91

ND = Not detected
NA = Not applicable

Reported By: David Patterson

Approved By: Sandra Jones

Metals

Total Metals

Client Name: Woodward-Clyde Consultants

Client ID: 9109-4

Lab ID: 015942-0004-SA

Matrix: SOIL

Authorized: 23 JUL 91

Sampled: 20 JUN 91

Prepared: See Below

Received: 23 JUL 91

Analyzed: See Below

Parameter	Result	Wet wt. Units	Reporting Limit	Analytical Method	Prepared Date	Analyzed Date
Arsenic	3.4	mg/kg	0.50	7060	24 JUL 91	24 JUL 91

ND = Not detected
NA = Not applicable

Reported By: David Patterson

Approved By: Sandra Jones

Quality Control Results

The Enseco laboratories operate under a vigorous QA/QC program designed to ensure the generation of scientifically valid, legally defensible data by monitoring every aspect of laboratory operations. Routine QA/QC procedures include the use of approved methodologies, independent verification of analytical standards, use of duplicate Laboratory Control Samples to assess the precision and accuracy of the methodology on a routine basis, and a rigorous system of data review.

In addition, the Enseco laboratories maintain a comprehensive set of certifications from both state and federal governmental agencies which require frequent analyses of blind audit samples. Enseco - Rocky Mountain Analytical Laboratory is certified by the EPA under the EPA/CLP program for both Organic and Inorganic analyses, under the USATHAMA (U.S. Army) program, by the Army Corps of Engineers, and the states of Colorado, New Jersey, New York, Utah, and Florida, among others.

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Control limits for accuracy (percent recovery) are based on the average, historical percent recovery +/- 3 standard deviation units. Control limits for precision (relative percent difference) range from 0 (identical duplicate DCS results) to the average, historical relative percent difference + 3 standard deviation units. These control limits are fairly narrow based on the consistency of the matrix being monitored and are updated on a quarterly basis.

For each batch of samples analyzed, an additional control measure is taken in the form of a Single Control Sample (SCS). The SCS consists of a control matrix that is spiked with either representative target compounds or surrogate compounds appropriate to the method being used. An SCS is prepared for each sample lot for which the DCS pair are not analyzed.

Accuracy for DCS and SCS is measured by Percent Recovery.

$$\% \text{ Recovery} = \frac{\text{Measured Concentration}}{\text{Actual Concentration}} \times 100$$

Precision for DCS is measured by Relative Percent Difference (RPD).

$$\text{RPD} = \frac{|\text{Measured Concentration DCS1} - \text{Measured Concentration DCS2}|}{(\text{Measured Concentration DCS1} + \text{Measured Concentration DCS2})/2} \times 100$$

All samples analyzed concurrently by the same test are assigned the same QC lot number. Projects which contain numerous samples, analyzed over several days, may have multiple QC lot numbers associated with each test. The QC information which follows includes a listing of the QC lot numbers associated with each of the samples reported, DCS and SCS (where applicable) recoveries from the QC lots associated with the samples, and control limits for these lots. The QC data is reported by test code, in the order that the tests are reported in the analytical results section of this report.

QC LOT ASSIGNMENT REPORT
Metals Analysis and Preparation

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
015942-0001-SA	SOIL	AS-FAA-S	24 JUL 91-L	24 JUL 91-L
015942-0002-SA	SOIL	AS-FAA-S	24 JUL 91-L	24 JUL 91-L
015942-0003-SA	SOIL	AS-FAA-S	24 JUL 91-L	24 JUL 91-L
015942-0004-SA	SOIL	AS-FAA-S	24 JUL 91-L	24 JUL 91-L

DUPLICATE CONTROL SAMPLE REPORT
Metals Analysis and Preparation

Analyte	Spiked	Concentration		Measured	AVG	Accuracy		Precision	
		DCS1	DCS2			Average(%)	(RPD)	DCS	Limit
Category: AS-FAA-S									
Matrix: SOIL									
QC Lot: 24 JUL 91-L									
Concentration Units: mg/Kg									
Arsenic	3.0	2.88	2.88	2.88	96	75-125	0.0	20	

Calculations are performed before rounding to avoid round-off errors in calculated results.

METHOD BLANK REPORT
Metals Analysis and Preparation

Analyte	Result	Units	Reporting Limit
Test: AS-FAA-S			
Matrix: SOIL			
QC Lot: 24 JUL 91-L QC Run: 24 JUL 91-L			
Arsenic	ND	mg/kg	0.50